Architecture + Aquaponics:
cookie cutter homes of the future

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December 2013

Submitted towards the fulfillment of the requirements for the Doctor of Architecture Degree

School of Architecture
University of Hawai'i at Mānoa

Doctorate Project Committee

Joyce M. Noe, Chairperson

Bradley K. Fox

Fred Lau

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We certify that we have read this Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in fulfillment as a Doctorate Project for the degree of Doctor of Architecture in the School of Architecture, University of Hawai'i at Mānoa.

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Acknowledgements

This journey would not have been possible with the support of my family, professors, mentors, and friends. To my family, thank you for encouraging me in all of my pursuits and inspiring me to follow my dreams. I am especially grateful to my parents who supported me emotionally and financially. I always knew that you believed in me and wanted the best for me. Thank you for teaching me that my job in life was to learn, to be happy, and to know and understand myself; only then could I know and understand others.

I would also like to give a special thanks to my committee. I owe a debt of gratitude to my Chairperson, Professor Joyce Noe for her support in ensuring I meet all the program requirements. I would especially like to thank Dr. Bradley K. Fox, topic leader for Aquaponics/Aquaculture, for accepting to volunteer as one of my aquaponics expert committee members, for taking the time to offer his knowledge and expert advice on any topic and for his careful attention to detail. Also, a special thanks to Mr. Fred Lau, aquaponics expert and owner of Mari's Garden, for taking time out of your busy schedule to help me understand aquaponics in a way that would not have been possible without your expertise, knowledge and passion on the topic.

A special thanks goes to the University of Hawai'i at Mānoa School of Architecture, Doctor of Architecture degree program for providing me with the opportunity to have a doctoral research project. I would also like to acknowledge Sasaki Associates, Inc., for providing expert advice and real world experience necessary for the completion of this project.

And last but not least to my friends, thank you for listening, offering me advice, and supporting me through this entire process. I will always remember the last minute coffee runs, 3am omelet times, and the "one hour" naps when we're awaken by sunrise. I would not have made it this far without each and every one of you.

Table of Contents

Abstract

With continued growth in population the demand for increased housing remains causing the need for traditional single family homes to be built. However, with sudden increase in developed areas predominantly relying on single family residential type developments, commonly known as “cookie cutter” type developments, the concern for more self-sustained design will continue to escalate.

This project provides an option for a self-sustained design of a single family home that includes a fully integrated aquaponics system. This type of development will present a new way of living for families who are interested in providing a healthier lifestyle for themselves and a greener future for their children. Using current tract homes as a design base to be utilized with aquaponics systems will create sustainable ways to address the need for a more self-sufficient design. The use of existing tract housing development will be altered to show how aquaponics can be integrated with current tract housing designs to improve standard trends.

This project will aim to create a new method of approach towards including self-sustenance in the continued growing demand of cookie cutter home designs in isolated and/or over populated locations such as Hawai’i.

Introduction

Overarching Theme & Background

As people become richer and move into cities, global demand for meat, fish, and vegetables will continue to grow, and by the year 2050 there will be another two billion people to feed.[1] As seen in Figure 1, the World Population: 1950-2050 chart, the population increased from three billion in 1959 to 6 billion by 1999, showing that the population nearly doubled in only 40 years. Furthermore, the latest projections for the near future imply that the population will increase another 50 percent in a 45 year span from 6 billion in 1999 to 9 billion by 2044. Proving that with natural resources such as water or more specifically biotic resources such as forests, animals, and fish quickly declining there will continue to be more pressure on natural systems for livestock farming and there will be a huge burden on the earth to meet the needs of our human future existence. Therefore, we need to find new ways of meeting these needs by

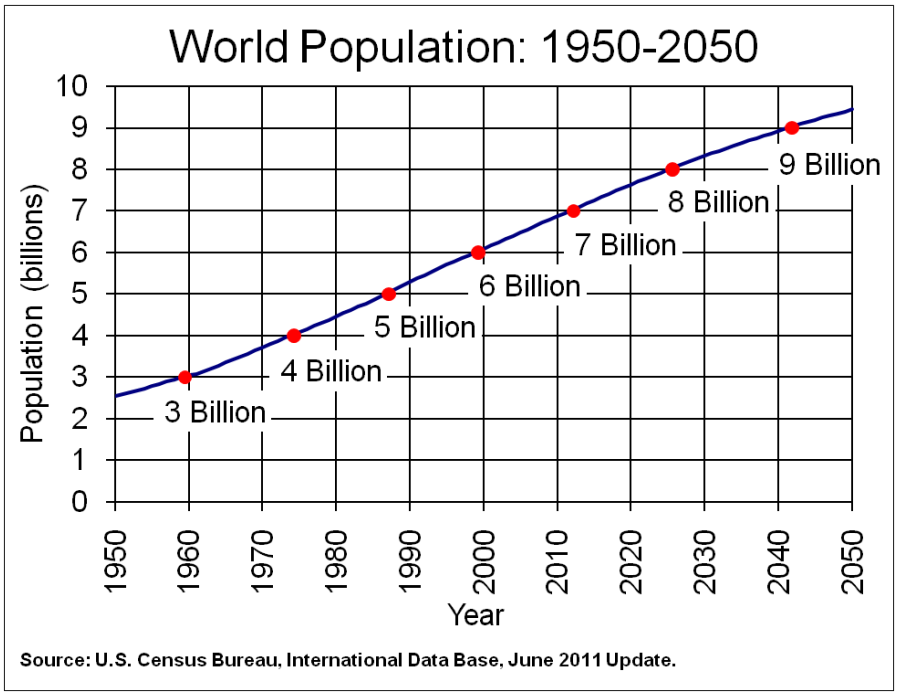

Figure 1: Increase of world population from 1950 to present with estimated trends of population from present to 2050
Source: http://www.census.gov/population/international/data/idb/worldpopgraph.php

[1] Bureau, United States Census. "United States Department of Commerce." *International Data Base.* June 2011. http://www.census.gov/population/international/data/idb/worldpopgraph.php (accessed October 6, 2012).

reducing our dependence on transportation of food sources and our unreliable habit of wasting earth's most viable element and source of life, water.

With the steady increase in water shortages, the conventional methods of farming are becoming less reliable. Although food security has been significantly increased in the past thirty years there continues to be an agricultural crisis with water withdrawals for irrigation representing 66% of the total withdrawals and up to 90% in arid regions, the other 34% being used by domestic households (10%), industry (20%), or evaporated from reservoirs (4%).[2]

Over the years the per capita use of water is estimated to increase dramatically due to changes in lifestyle and population growth; meaning that the water used to produce food for human consumption, industrial processes and all other uses will continue to be scarce.[3] Within the next fifty years, the world's population will increase by another 40 to 50%; resulting in an increasing demand for water that will lead to loss of the aquatic ecosystems and their dependent species.[4]

Why Aquaponics?

So why aquaponics? With the world population growth showing a continuous increase there will be inevitably less farmable land due to the need for more housing and support facilities, as well as an increased demand for food and water. The decrease in farmable land will also result in declines in crop production and fishing which could eventually lead to increase in related job losses.

Crop production and fishing are both expected to see declines in the next few years, according to the Employment Projections for Industries and Occupations 2008-2018, most of Hawaii's

[2] Shiklomanov, Igor A. *Water Crisis: Towards a way to improve the situation.* 1999. http://webworld.unesco.org/water/ihp/db/shiklomanov/index.shtml (accessed August 29, 2013).

[3] Hollander, Jim. *Water Crisis.* 2012. http://www.worldwatercouncil.org/library/archives/water-crisis/ (accessed August 31, 2013).

[4] Hollander, Jim. *Water Crisis.* 2012. http://www.worldwatercouncil.org/library/archives/water-crisis/ (accessed August 31, 2013).

industries are projected to grow, but there are eleven that are expected to endure employment declines.[5]

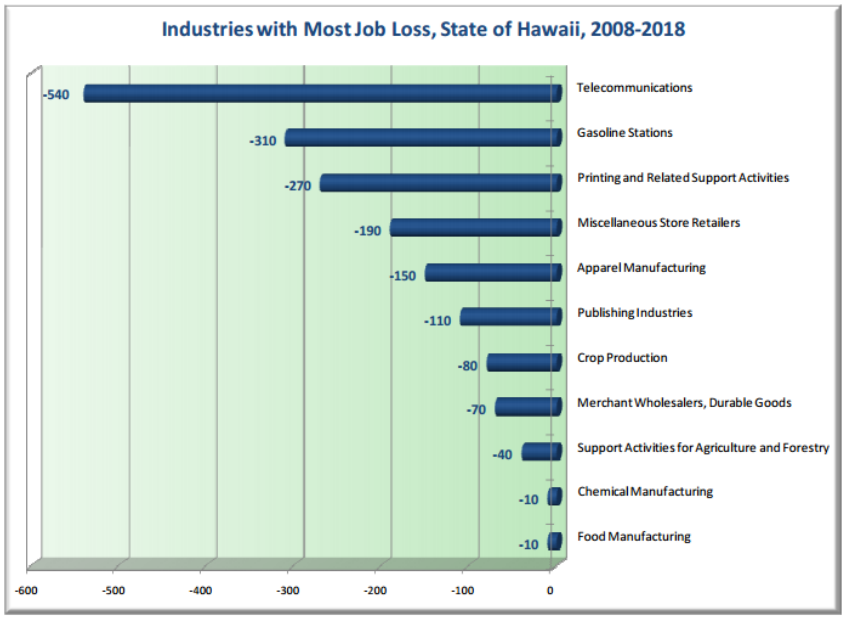

Figure 2: Crop Production job loss in the state of Hawaii from 2008-2018
Source: http://manoa.hawaii.edu/ovcaa/planning_approval/pdf/Long-Term%20Projections%202008-18.pdf

As seen in Figure 2, crop production is estimated to eliminate up to 80 jobs in the next five years. And in the job loss list of *Long-term Industry Projections, State of Hawaii, 2008-2018;* natural resources such as fishing is estimated to decline and average annual growth of -0.1%. Figure 3 shows a detailed average of job loss projections in the state of Hawaii over the course of ten years.

With aquaponics integrated as part of tract homes/cookie cutter: as defined by Merriam Webster Dictionary "a house that is one of many similar houses built on an area of land",[6] with this type of design there will be less need for farmable land, it could help to meet increase demands for food and water, it improves current suburban living styles by providing a more

[5] Relations, Hawaii State Department of Labor and Industrial. "State of Hawaii Planning Approval." *Employment Projections for Industries and Occupations 2008-2018.* September 2010. http://manoa.hawaii.edu/ovcaa/planning_approval/pdf/Long-Term%20Projections%202008-18.pdf (accessed August 30, 2013).

[6] 2013. *Tract House: Merriam-Webster Dictionary.* Accessed November 27, 2013. http://www.merriam-webster.com/dictionary/tract%20house.

sustainable option for living, and most importantly it could create more jobs through support maintenance facilities for single-family home aquaponics systems.

Long-term Industry Projections, State of Hawaii, 2008-2018						
NAICS Code	Industry Title	Employment 2008	Employment 2018	Growth Net	Growth Percent	Avg. Ann. Growth
000000	TOTAL EMPLOYMENT	685,950	734,790	48,840	7.1%	0.7%
101000	Goods-Producing	59,370	62,540	3,170	5.3%	0.5%
101100	Natural Resources and Mining	7,050	6,990	-60	-0.9%	-0.1%
110000	**Agriculture, Forestry, Fishing and Hunting**	**6,720**	**6,620**	**-100**	**-1.5%**	**-0.1%**
111000	Crop Production	5,290	5,210	-80	-1.5%	-0.2%
112000	Animal Production	650	650	0	0.0%	0.0%
114000	Fishing, Hunting and Trapping	150	160	10	6.7%	0.7%
115000	Support Activities for Agriculture and Forestry	620	580	-40	-6.5%	-0.6%
210000	**Mining**	**330**	**360**	**30**	**9.1%**	**0.9%**
212000	Mining (except Oil and Gas)	330	360	30	9.1%	0.9%
101200	Construction	37,470	40,440	2,970	7.9%	0.8%
230000	**Construction**	**37,470**	**40,440**	**2,970**	**7.9%**	**0.8%**
236000	Construction of Buildings	11,700	12,810	1,110	9.5%	0.9%
237000	Heavy and Civil Engineering Construction	4,940	5,540	600	12.1%	1.2%
238000	Specialty Trade Contractors	20,830	22,090	1,260	6.0%	0.6%
101300	Manufacturing	14,850	15,110	260	1.8%	0.2%
310000	**Manufacturing**	**14,850**	**15,110**	**260**	**1.8%**	**0.2%**
311000	Food Manufacturing	6,120	6,110	-10	-0.2%	0.0%
312000	Beverage and Tobacco Product Manufacturing	910	970	60	6.6%	0.7%
313000	Textile Mills	50	60	10	20.0%	2.0%
314000	Textile Product Mills	240	260	20	8.3%	0.8%
315000	Apparel Manufacturing	580	430	-150	-25.9%	-2.6%
322000	Paper Manufacturing	150	170	20	13.3%	1.3%
323000	Printing and Related Support Activities	1,080	810	-270	-25.0%	-2.5%
325000	Chemical Manufacturing	350	340	-10	-2.9%	-0.3%
326000	Plastics and Rubber Products Manufacturing	270	290	20	7.4%	0.7%
327000	Nonmetallic Mineral Product Manufacturing	1,150	1,180	30	2.6%	0.3%
332000	Fabricated Metal Product Manufacturing	450	480	30	6.7%	0.7%
333000	Machinery Manufacturing	50	50	0	0.0%	0.0%
334000	Computer and Electronic Product Manufacturing	130	140	10	7.7%	0.8%
336000	Transportation Equipment Manufacturing	820	990	170	20.7%	2.1%
337000	Furniture and Related Product Manufacturing	550	580	30	5.5%	0.5%
339000	Miscellaneous Manufacturing	1,090	1,290	200	18.3%	1.8%
102000	Services-Providing	566,990	609,880	42,890	7.6%	0.8%
102100	Trade, Transportation, and Utilities	117,940	125,300	7,360	6.2%	0.6%
420000	**Wholesale Trade**	**18,740**	**20,220**	**1,480**	**7.9%**	**0.8%**
423000	Merchant Wholesalers, Durable Goods	6,920	6,850	-70	-1.0%	-0.1%
424000	Merchant Wholesalers, Nondurable Goods	9,940	11,300	1,360	13.7%	1.4%
425000	Wholesale Electronic Markets and Agents and Brokers	1,880	2,070	190	10.1%	1.0%
440000	**Retail Trade**	**69,760**	**73,310**	**3,550**	**5.1%**	**0.5%**

Figure 3: Average job loss projections in Hawaii from 2008-2018
Source: http://manoa.hawaii.edu/ovcaa/planning_approval/pdf/Long-Term%20Projections%202008-18.pdf

Why Tract Housing Development?

Percentages of single family home development have shown a recent increase in the Ewa and Kapolei regions of Oahu. As seen in the Forecasts chart in Figure 4, the National Association of Home Builders shows that there was a twenty-one percent increase for single-family homes in 2012 and it is forecast to increase another twenty-six percent by the end of 2013, compared to the decline of multifamily homes decrease of nearly twenty percent.[7]

With population increase, global demand for food and water, growth of tract housing and dependence on imported goods, it becomes essential to understand the importance of looking

[7] Barringer, Tory. 2012. *NAHB: Housing Construction on Track for Growth in Coming Years.* October 19. Accessed September 30, 2013. www.themreport.com/articles/nahb-housing-construction-on-track-for-growth-in-coming-years-2012-10-19.

into more self-sustained methods that are conscious of creating better alternatives for current and future generations.

Forecasts

	Single-family (units)	Annual Change	Multifamily (units)	Annual Change	Remodeling (billion$)	4Q/4Q Chg
1995-2003	1,256,000		331,000		100	
2010	471,000		114,000		104	
2011	434,000	-8%	178,000	56%	103	3.5%
2012	**528,000**	**21%**	**224,000**	**26%**	**106**	**0.8%**
2013	**665,000**	**26%**	**238,000**	**6%**	**111**	**3.2%**
2014	**865,000**	**30%**	**275,000**	**16%**	**114**	**3.2%**

National Association of Home Builders

NAHB

Figure 4: NAHB Forecasts for Single-family/Multifamily Homes from 2013-2014
Source: http://www.themreport.com/articles/nahb-housing-construction-on-track-for-growth-in-coming-years-2012-10-19

Initial Arguments

Architecture design should include more innovative self-sustained methods such as aquaponics, especially in places such as Hawaii, which rely solely on imported goods. The survival of Hawaii relies on imports, where aquaponics intent is to help encourage self-reliance. More self-sustained methods such as aquaponics should be included as part of architecture design.

Since traditional farming primarily involves growing food in the ground, the basics of how food is grown and transported have not changed. However, considering the lack of open farmable land, increase of global water shortages and unreliable weather conditions, particularly in Hawaii, growing plants in the ground is quickly becoming an unrealistic way of providing a healthy source of food. Growing food in the ground requires an immense amount of labor, including expensive energy consuming machinery to complete various tasks; till soil, add

fertilizer, and plant and harvest crops. In addition, with organic gardening, working organic materials into the soil adds an extra task to the already labor intensive process of farming. Furthermore, with conventional farming methods large amounts of fertile land is required which often lead to massive amounts of energy use due to the need for transportation of water to fertile lands.

For aquaponics since soil is not needed and water is being recirculated it avoids having to do labor intensive work such as working the soil, adding fertilizer or organic materials, and most importantly there is no need for scarce land with fertile soil. Since water is no longer being wasted in the ground, through a closed loop recirculating system, the nutrients from the fish water are now delivered directly to the roots of the plants, allowing crops to harvest in half the time year round while using as little as 2% of the water that conventional farming uses.

An aquaponics system can be set up anywhere that adequate light is available, and where temperature extremes can be avoided or altered. This opens up areas of the world with poor soils and little water to become lush producers of quality organic produce, while naturally fertile lands can be freed up for other uses or left as a natural habitat.

Aquaponics also provides a good source of edible fish. And since there are many concerns about the safety of imported fish and the impact of harvesting wild fish, people are turning to domestic fish farming, more formerly known as aquaculture. However, the popular fish farming usually requires a constant large supply of fresh water and produces a lot of waste water full of high concentrations of fish wastes, which are often dumped into the environment. Aquaponics, on the other hand, has the benefit of farming fish alongside the crops without the pollution and demand for large amounts of water required for aquaculture.

In that sense, architects should consider including aquaponics in architectural design because it provides more self-reliance and illustrates sustainability which is fundamental to the survival of both isolated and/or over populated areas such as Hawai'i.

Research Questions

The following lists research questions that will be addressed throughout the duration of the project:

1. What are some ways of practicing self-sustainability for medium income families?
2. How can the Architectural Engineering and Computer Aided Design (AEC) industry be better leaders of self-sufficiency?
3. What are the main reasons for using aquaponics?
4. What are some of the issues for self-sustained practices such as aquaponics?

Project Focus

There are various innovative ways to integrate self-sustained practices in the field of architecture. The focus of this project will help to increase awareness of different self-sustaining methods such as aquaponics, encourage AEC to provide better sustainable living environments through aquaponics, preserve the quality of life and the future of Hawaii through aquaponics and encourages a more self-reliant culture. Through research and design, investigations will be made on the various ways that aquaponics could be integrated into the practice and design of architecture. Since traditional farming is quickly becoming part of the past, this project will focus on ways to implement self-sustaining methods, such as aquaponics, into current designs of single family residential homes.

Recent building trends have shown that there was a twenty one percent increase in single family homes in 2012 and it is forecast to increase another 26 percent by the end of 2013 as seen in the forecast by the National Association of Home Builders.[8] Although this project will focus on single family homes, particularly Trades by Gentry, the main focus of this project is not the location but the single family home trend and how this doctorate project could enhance self-sustained living which will help Hawaii continue to thrive.

[8] Barringer, Tory. 2012. *NAHB: Housing Construction on Track for Growth in Coming Years.* October 19. Accessed September 30, 2013. www.themreport.com/articles/nahb-housing-construction-on-track-for-growth-in-coming-years-2012-10-19.

Project Goals

The goals for this thesis project will be as follows:

1. Bring awareness to the importance of self-sustenance.
2. Investigate aquaponics as a self-sustained practice.
3. Demonstrate that aquaponics is viable for novice users.
4. Show that AEC can lead the way for self-sustained aquaponics.

These goals will be completed through integrating aquaponics systems in single family residential home designs and providing examples of how this type of architecture could work with current tract housing developments. It is in hopes that this doctoral project results in a new architectural trend that establishes a better way to provide options of self-sustenance such as aquaponics through current and future architecture designs.

Audience & Outcomes

The audience of this project includes the School of Architecture and College of Tropical Agriculture and Human Resources under the Department of Molecular Biosciences and Bioengineering, including single family developers and future and current tract housing homeowners. This project aims to create an innovative design for the future of cookie cutter home developments in hopes that the idea will enhance current developments to create more innovative designs that is better for our environment and enhances the future of our children. This research will provide insights on issues pertaining to the current housing developments in Hawaii and brings awareness to what can be done to create a better lifestyle.

This project aims to create an idea through the design of cookie cutter homes in locations like Ewa Beach to provide better alternatives to residential developments in over populated and/or isolated areas.

End Project & Level of Development

The end project is to provide a design example of single family homes that bring awareness to the importance of self-sustenance through aquaponics. The design of the medium income family home will focus on the current trends of cookie cutter family homes, particularly in the Ewa and Kapolei regions of the island of Oahu where development for residential homes are increasing.

Currently the need for residential development is continuously growing, so this project will aim to design a home that is integrated with an aquaponics system. Many of the do it yourself aquaponics that claim to create simple farming methods for produce and fish end up generating more costs than the user anticipated since a "successful fish tank requires constant monitoring of everything: PH levels, Nitrates/Nitrites, & temperature. If any of these measurements get out of whack, prompt corrective action is needed to prevent further deterioration".[9] With aquaponics already integrated into the design the user will have a fully cycled system that creates fresh produce and fish for the family along with other important sustainable aspects such as solar insulation, green roof, reduced water runoff and lowered effects of heat islanding. Similar to current tract housing developments, the home owner will have the option of choosing from three design options which could be integrated into the four single family home layouts ranging from three to four bedrooms. Although only one plan design will be used for this doctoral project, three options for aquaponics design integration will be provided for the final outcome. The current problems with "do it yourself" aquaponics systems will be discussed and solutions to those problems will be provided through concept design and investigation.

The final level of development will consist of a single family home design integrated with an aquaponics system designed to accommodate fresh produce and fish for a the home owner and their family. This doctoral project is intended to provide future generations with a new innovative way of being more self-sustained through the use of aquaponics integration with single family residential homes.

[9] Robb, John. 2013. *One way to make aquaponics easier.* August 7. Accessed September 10, 2013. http://www.resilientcommunities.com/one-way-to-make-aquaponics-easier/.

Enhancement of my own Educational & Professional Interests

This project will help to enhance both my educational and professional interests through understanding the importance of the relationship between architecture and nature. Although the concept of aquaponics have been around for a few years, this project will allow me to explore different innovative ways to implement new creative ideas into future architectural designs.

Generating aquaponics systems that can be integrated with single family residential homes could also influence future designs to include more self-sustained methods such as aquaponics through many different settings; suburban, urban, rural and possibly community settings. This opportunity will enhance not only my educational and professional goals in the future, but will also provide a new viable self-sustained method for creating a better lifestyle for current and future generations.

This project will also look into a variety of contexts that will allow me to grow as a professional architect through providing a better understanding for regional weather allowance, species for specific conditions based on location, types of plants that work best with different systems, and how aquaponics could be implemented with architecture to suit both aquaponics and architectural needs.

Physical and Theoretical Context

The Ewa Gentry homes are a perfect example of what is currently trending in Hawai'i. With the continued growth in population, more land is being dedicated to single family housing developments. For this project, Trades by Gentry will be used as a design base to show how tract housing can be improved with the use of self-sustained methods such as aquaponics. Although Gentry housing development and its location is not the focus of this project, the overall idea of tract housing will be used to show comparisons between tract housing with and

without aquaponics to provide legitimate evidence that tract housing could be improved with the integration of more sustainable design methods.

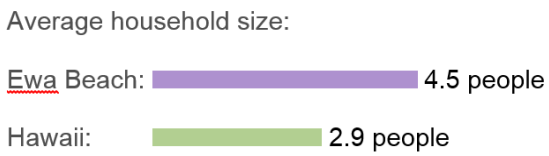

Figure 5: City Data for Ewa Beach, Hawaii
Source: http://www.city-data.com/city/Ewa-Beach-Hawaii.html

According to the chart in Figure 5, provided by the City Data website for Ewa Beach, Hawaii, the average household size is four to five; therefore, the square footage of each design of the home will be based on four to five bedrooms. Currently, homes that are designed and placed within a community are based on cookie cutter type developments that try to sell the idea of "going green" allowing buyers to invest in homes that already include energy efficient appliances, low-e glazing, solar heat panels, photovoltaic systems, and so on. This project will give interested buyers the option of living in a community that cares about our environment and the future of our children through homes that are designed to provide a better way of living through self-sustained methods such as aquaponics.

While this project includes case studies and examples of the integration of self-sufficient architectural design, the main physical context will focus on Trades by Gentry's residential single family housing development as a design base to show how tract housing can be improved with the use of sustainable approaches.

Other Pertinent Conditions & Parameters

Some other important conditions and parameters that relate to this doctoral project include:

1. The lack of information pertaining to the integration of aquaponics and architecture
2. The number of facilities available to test the idea of integrating aquaponics and architecture at a residential scale.

Although the outcome of this project includes a design example of the integration of aquaponics and architecture, an experimental research project or other evaluative research necessary to test the development of the final design will not be part of the doctoral project. However, it is the intent of this project to demonstrate the idea of including self-sufficiency such as aquaponics for tract housing to emerge in the near future.

Extended Literature Review

Before suggesting an example of the integration of aquaponics in a residential development setting, the following literature reviews will provide an in-depth background for the main reason behind the lack of self-sufficiency in places such as Hawaii that are isolated and/or over populated. The literature reviews are:

1. Understanding Sustainability
2. The Importance of Self-sufficiency
3. Why cookie cutter housing development?

Understanding Sustainability

Sustainability is a word that has been tossed around for quite some time; however, many people still lack the knowledge of where it came from and why it is so important. In the United States, the first establishment of a national policy for environmental sustainability came in 1969 with the passage of the National Environmental Policy Act (NEPA) whose purpose was to "foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of present and future generations".[10] Since then more people have been putting in the extra effort to learn and understand the issues of reducing their impacts on the environment through bringing awareness and promoting green practices such as recycling, saving water, etc. The United States Environmental Protection Agency, also known as EPA, states that sustainability emerged as a result of significant concerns about the unintended social, environmental, and economic consequences of rapid population growth, economic growth and consumption of our natural resources.[11] This shows that sustainability is more than materials and building methods but also about healthier daily lifestyles and a better environment for future generations.

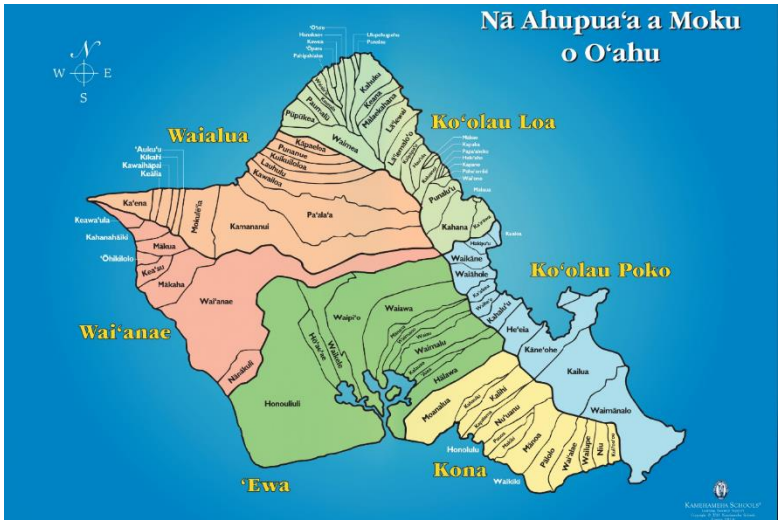

Figure 6: O'ahu map of Ahupua'a divisions
Source: http://gigapan.com/gigapans/135099

[10] Agency, United States Environmental Protection. *History of Sustainability.* September 24, 2013. 2013 (accessed September 24, 2013).

[11] *What is EPA doing?* September 24, 2013. http://www.epa.gov/sustainability/basicinfo.htm (accessed September 24, 2013).

Similar to recent examples of sustainable techniques such as the use of photovoltaic panels, grey water reuse, wave energy for electricity, wind power, and so on, the original Hawaiian lifestyle was not so different; having the same ideas in mind. Traditionally, Hawaiian life was based around the ahupua'a system of sustainable land management. Geopolitical land divisions formed the basis of Hawaiian culture, which was void of any concept of private property.[12] This ahupua'a system used to be the main basis of survival. Figure 6 shows an example of how the island of O'ahu was divided using a complex system of land division known as Ahupua'a. An ahupua'a is a narrow wedge-shaped land section that runs from the mountain to the sea. The size of each ahupua`a dependant on the resources of the area with poorer agricultural regions split into larger ahupua`a to compensate for the relative lack of natural abundance.[13] Figure 7 below shows an example of how an ancient ahupua'a system worked. Shaped by island geography, each ahupua`a was a wedge-shaped area of land running from the uplands to the sea, following the natural boundaries of the watershed. Each ahupua`a contained the resources

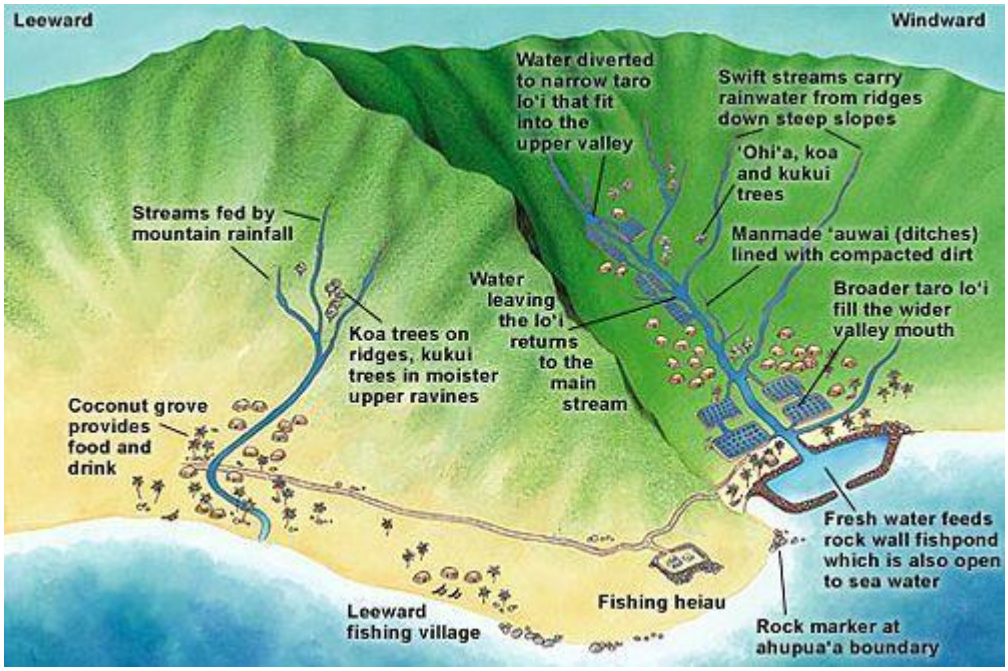

Figure 7: Ancient Ahupua'a System
Source: http://www.hawaiihistory.org/index.cfm?fuseaction=ig.image&FileName=img448.jpg

[12] Lee Jr., Herb M. 1994. *EWRI Currents: Ahupua'a.* Accessed September 25, 2013. http://email.asce.org/ewri/Ahupuaa.html.

[13] Grafik, Info. n.d. *Ahupua'a.* Accessed October 2, 2013. http://www.hawaiihistory.org/index.cfm?fuseaction=ig.page&CategoryID=299.

the human community needed, from fish and salt, to fertile land for farming taro or sweet potato, to koa and other trees growing in upslope areas.[14] People living in one *ahupua'a* were free to use whatever grew wild in that *ahupua'a*, but a resident of one *ahupua'a* could not take anything from another *ahupua'a.* Boundaries were important and people carefully learned their locations.[15] However, since this is no longer a viable solution there needs to be better alternatives to creating sustainable approaches for providing more options and solutions in the continued growing demand of future home designs.

With the increase in population over the past few years, the demand for meat, fish and vegetables are continuously growing causing an inevitable reliance on imported goods and transportation of food to increase supply. This is why overpopulated and/or isolated areas such as Hawai'i need to find more productive self-sustainable ways to reduce our reliance on transportation of food particularly fish and produce.

The Importance of Self-Sufficiency

Places such as Hawaii have the opportunity to make homes more "green" or sustainable, however many cookie cutter type developments try to sell the idea of saving money through reducing energy costs with the implication that that they are reducing their carbon footprint by using Energy Star appliances, LED lighting, photovoltaic panels, and so on. Although this may be true, this still does not provide self-sufficiency in a location that relies on daily imported food resources. Despite Hawai'i's plentiful agricultural land and year-round growing conditions, we still import more than 85% of our food and have less than a 7-day supply of food in stores at any given time.[16] Many Hawai'i residents are concerned about community food security due to our

[14] Grafik, Info. n.d. *Ahupua'a.* Accessed October 3, 2013. http://www.hawaiihistory.org/index.cfm?fuseaction=ig.page&CategoryID=299.

[15] Williams, Julie Stewart. 2007. *From the Mountains to the Sea: Early Hawaiian Life.* Honolulu: Kamehameha Schools Press.

[16] Elevitch, Craig. 2013. *Hawai'i Homegrown Food Abundance.* October 1. Accessed October 2, 2013. http://www.agroforestry.net/hhfa/.

food distribution system's vulnerability to major economic disruptions and environmental disasters.[17] Some of the problems include the following:

- low availability and high price of locally grown food in markets and restaurants
- stagnation of the local agricultural economy due to cheap imports
- increasingly questionable food safety from imported foods of nearly untraceable origin
- poor nutrition due to overconsumption of cheap processed foods
- skyrocketing medical costs due to nutrition related non-communicable diseases[18]

This is why sustainability should include being more self-reliant because it provides the people of Hawaii with a viable solution that is essential for the future of Hawai'i.

Table 1. Hawai'i's Current Agricultural Acreage and Additional Acreage Required for Food Self-sufficiency

Use	Current acres	Additional acres required for self-sufficiency
Vegetables, taro, sweet potato	6,400	15,000 (potato 2,300 acres, sweet potato 410, taro 8,300 acres)
Rice	0	12,750 (10)
Wheat, soybeans, corn	0	50,000 (11)
Sugar	40,000	Ethanol production from current sugar cane acreage
Pineapple	14,000	0
Fruits	6,200	1200
Macadamia	18,300	0
Coffee	8,000	6,000 (12)
Other crops	9,100	0
Beef cattle		36,000 (13)
Dairy		20,000 (14)
Poultry and hogs		(15)
Total	**102,000**	**140,950**
Estimated acreage for near self-sufficiency in food does not include additional acreage for fuel beyond current land in sugar.	242,950	

Figure 8: Hawai'i's Acreage Required for Food Self-sufficiency
Source: http://hawaii2050.org/images/uploads/HI2050_web5.pdf

[17] Elevitch, Craig. 2013. *Hawai'i Homegrown Food Abundance.* October 1. Accessed October 2, 2013. http://www.agroforestry.net/hhfa/.

[18] Elevitch, Craig. 2013. *Hawai'i Homegrown Food Abundance.* October 1. Accessed October 2, 2013. http://www.agroforestry.net/hhfa/.

Considerations of sustainability often invoke thoughts about self-sufficiency, however, while neither the state department of Agriculture Business, Economic Development, and Tourism has an index of imported food consumption, it is generally agreed that over 80 percent of what we consume is imported.[19] The table in Figure 8 provides *Hawaii's Current Agricultural Acreage and Additional Acreage Required for Food Self-sufficiency*, proving that the acres required for self-sufficiency in Hawaii are about 249,000 acres, however by "extrapolating from data about consumption habits and acreage needed per product, we calculate that near self-sufficiency would require an estimated 243,000 acres — and that does not include frozen, canned, or dried fruits and vegetables sold in restaurants and stores, which is only to meet projected resident needs in 2007, not those from the swelling visitor and resident populations expected by 2050".[20] So how can we change this? With the rise of tract housing development in non-agricultural land such as Ewa Beach and Kapolei where green living is being addressed through eco-friendly and energy saving designs; a healthier environment due to sustainable features. Perhaps the focus of architectural designs should also address self-sufficiency through implementations such as aquaponics; provide families with healthier living lifestyles.

Cookie Cutter Housing Development

Tract housing, also known as cookie cutter housing, is a type of housing development in which

Figure 9: Cookie Cutter Housing Development
Source: http://www.newgeography.com/content/00983-cookie-cutter-housing-wrong-mix-for-subdivisions

[19] Lee, C.N., H.C. "Skip" Bittenbender. 2010. *Hawai'i 2050: Building a Shared Future.* February 10. Accessed September 19, 2013. http://hawaii2050.org/images/uploads/HI2050_web5.pdf.

[20] Lee, C.N., H.C. "Skip" Bittenbender. 2010. *Hawai'i 2050: Building a Shared Future.* February 10. Accessed September 19, 2013. http://hawaii2050.org/images/uploads/HI2050_web5.pdf.

multiple similar homes are built on a tract of land which is subdivided into individual small lots.[21] Due to the limited time constraints, designs often focus on constructability of time, materials, and availability which does not always result in the best outcome for developing communities. This is one of the many reasons why there needs to be better sustainable alternatives for tract housing development, such as an integrated option of aquaponics in a single family home.

Since most land developers and contractors embrace the cookie cutter house due to discounts in buying bulk materials and only needing to purchase two or three architectural renditions that are then used for the development of several homes[22], there needs to be more sustainable options that look towards helping the present and sustaining the future. If sustainable options such as aquaponics are included as part of the design of tract housing, it will help to educate current users and their children on the importance of understanding where our food comes from and why it is vital to our future.

[21] Dictionary.com. WordNet® 3.0. Princeton University. 2006. *Tract Housing.* Accessed August 16, 2013. http://dictionary.reference.com/browse/tract housing.

[22] Kopec, David. 2003. *Attack of the Cookie-Cutter Home.* May 27. Accessed October 22, 2013. http://realtytimes.com/agentnews/agentadvice1/item/14286-20030528_cookiecutter.

Research Documentation

Research Methodology

The methodology use for this project will be design based. Aquaponics ecosystems must have proper balance to maintain healthy fish and plants, therefore research will be done as a design guide to assess what is the best method to use in terms of the following: types of fish and plants that work best together, size of aquaponic systems that works best with the types of fish and plants that will be used, for health purposes how many fish and plants versus amount of water should be maintained, temperature and lighting conditions, and possible applications based on research. Case studies will be included as well as design base examples to prove findings and will also be used to illustrate how aquaponics is successful in various locations. Designs in the form of a conceptual model will use various media to illustrate key points. A journal will record findings of research and to log thoughts and/or opinions throughout the design process. Site visits will be directed to aid in understanding of aquaponics and farming in terms of the history, basic farming, governments role in farming, the environment, the future to farming in the United States, other possible controversial topics in agriculture that will set up a foundation for reasons traditional farming is no longer viable and why it is important to introduce and understand the importance of aquaponics in the architecture practice.

The main purpose of this research project is to understand the importance of aquaponics and to explore aquaponics as a viable self-sustaining application to be considered as architecture practice and design. Currently aquaponics is known as an innovative concept that mimics nature's most efficient way of growing food by combining hydroponics (soil-free cultivation of plants in water) and aquaculture (raising of fish or other aquatic animals in tanks or ponds), creating what is called aquaponics a sustainable food production system that produces no waste.

Aquaponics has been around for many years but only recently has it been noticed as a viable solution to help minimize the depletion of our natural resources and to provide sustenance to our vastly growing population. With aquaponics in mind, the goal of this project will be to design a an aquaponics systems that is fully integrated with architectural design to show how current tract housing can be improved to provide Hawaii with a sustainable option of self-

reliance through aquaponics; areas that do not have the space or lack the type of soil or land that is typically needed to grow healthy organic fish and produce. The projects outcome would result in people having the opportunity to create a healthier lifestyle for current and future generations.

The main focus of the project will be to do research and further the existing findings on aquaponics, while helping to aid in the development of a new paradigm of integration that could serve both aquaponics and architecture.

Hawaii relies on 80% of imported food and it is important for AEC to be the leaders to push more self-sustainable movements so that people can thrive. The main focus of the project that is being proposed is for aquaponics to be one of the self-sustaining methodologies. Self-sustaining practices such as aquaponics will help to enable people in Hawaii to be more self-supported.

Companion Planting: What Plants Grow well Together

Companion planting is the art of putting plants that get along next to each other to create beneficial plant associations that help to use gardening space more efficiently, repel unwanted pests and support beneficial animals such as bees that pollinate.[23]

The following companion planting charts illustrate both the antagonistic, or dislike, and beneficial relationships between commonly used plants for planting companion vegetables and herbs.

[23] 2013. *Guide and Charts on Planting Companion Vegetables and Herbs, and Fruit Tree Companion Planting.* Accessed May 20, 2013. http://www.small-farm-permaculture-and-sustainable-living.com/planting_companion_vegetables_and_herbs.html.

Figure 10 provides a chart of companion planting that lists plants that grow well together in the same circle, either as mutually beneficial companions or neutral neighbors. Those that do not share the same circle should not be grown together.[24] For example, potato grows best with

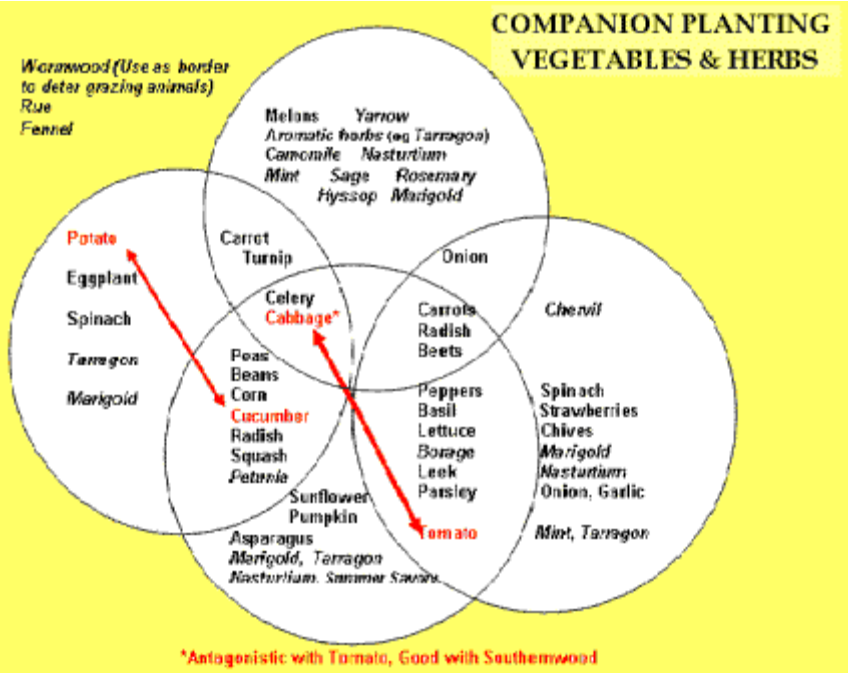

Figure 10: Chart of Companion Planting for Vegetables and Herbs
Source: http://www.small-farm-permaculture-and-sustainable-living.com/planting_companion_vegetables_and_herbs.html

eggplant, spinach, tarragon and marigold since they share the same circle, however, potato will also grow well with neighboring peas, beans, corn, radish, squash, petunia, celery, carrot and turnip, who also share the same circle. Although potato and cucumber share the same circle in the diagram, the arrow between them denotes an antagonistic relationship, meaning they do not grow well together; the same is true for cucumber and potato.

Fish should also be considered when choosing which plants grow best together because both plants and fish should have similar needs such as temperature and pH, or level of acidity, in the water.[25] Some of the most common fish that are raised in aquaponics are tilapia, blue gill, koi,

[24] 2013. *Guide and Charts on Planting Companion Vegetables and Herbs, and Fruit Tree Companion Planting.* Accessed May 20, 2013. http://www.small-farm-permaculture-and-sustainable-living.com/planting_companion_vegetables_and_herbs.html.

[25] Agency, U.S. Environmental Protection. 2012. *What is pH?* December 4. Accessed September 3, 2013. http://www.epa.gov/acidrain/measure/ph.html.

goldfish, catfish, carp, perch and trout. Plants that are known to do well in an aquaponics system are leafy lettuce, kale, swiss chard, arugula, basil, mint, watercress, chives and most common house plants. Other plants that also do well if the fish tank is heavily stocked and healthy but require higher nutritional demands are tomatoes, peppers, cucumbers, beans, peas, squash, broccoli, cauliflower, and cabbage.[26]

Plant and Fish Pairings

The plant and fish pairings that are provided is based on research of types of fish that grow well together and plant companion charts. The following are suggested pairing options for this doctoral project design:

- Tilapia with lettuce
- Catfish and blue gill with tomatoes, cucumbers, squash and/or melons
- Koi or Goldfish with cabbages, broccoli, cauliflower, radishes and kale

However, it has been mentioned by aquaponics expert Fred Lau, a landscape contractor who has dedicated one acre at his Mililani nursery called Mari's Garden to aquaponics,[27] that for a media grow bed of 2 x 3 or 3 x 5 and a tank size no deeper than 18 inches or more than 1,500 gallons of water, "any mixture of plants and fish could work; it is just a matter of

Figure 11: Manoa lettuce in a grow bed at Mari's Garden
Source: http://www.hawaii.edu/malamalama/wp-content/uploads/2011/04/f_aquaponics.jpg

[26] Nelson and Pade, Inc. 2010. *Recommended Plants and Fish for Aquaponics.* Accessed August 1, 2013. http://aquaponics.com/page/recommended-plants-and-fish-in-aquaponics.

[27] Ernst, Cheryl. 2011. *Aquaponics System Grow Food Sustainably.* April 18. Accessed November 24, 2013. http://www.hawaii.edu/malamalama/2011/04/aquaponics/?pid=357.

maintenance".[28] Since this design includes an onsite facility maintenance guarantee, there should be no problems with pairing options.

Environmental Impacts

Depending on the ratio of fish grown to plants grown, every drop of water and energy can be reused in aquaponics highly-efficient closed-loop system, where fish and vegetables grow symbiotically to cultivate produce and protein sustainably and profitably in urban cites. Aquaponics is a sustainable food production system that combines traditional aquaculture with hydroponics. It uses nutrient-rich water from fish culture to irrigate and fertilize plants, which absorb the nutrients and return clean plant filtered water back to the fish, resulting in efficient use of resources.[29] The diagram on the right shows the general process of aquaponics closed loop system.

Business Aspects

> "Businesses should balance profit with natural resources"[30]
>
> -- Jiro Ono

Looking at aquaponics from a business perspective, it is important to use good agricultural practices; to verify that fruits and vegetables are produced, packed, handled, and stored in the safest manner possible to minimize risks of microbial food safety hazards.[31] By using good agricultural practices it reduces the amount of time and money being spent on minor mistakes that could damper food safety; it reduces your business risk of liability for example selling produce leads to becoming a commercial provider which essentially leads to certain responsibilities; there is a higher probability of keeping a customer that may require an on-farm food safety certification; and it could improve changes that customers will feel justified if paying a higher price for your produce.[32] To the left is an image of a commercial aquaponics system in Loveland, Colorado that are usually designed and used for large scale production so that high

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[28] Lau, Fred, committee meeting 3 to Gina Takahashi, October 30, 2013.

[29] Hollyer, Jim, and Clyde Tamaru. *On-Farm Food Safety: Aquaponics.* Honolulu: College of Tropical Agriculture and Human Resources (CTAHR), July 2009.

[30] 2012. *Jiro Dreams of Sushi.* Directed by David Gelb. Performed by Jiro Ono.

[31] Agriculture, United States Department of. *Fresh Fruit and Vegetable Audit Programs.* August 27, 2012.

[32] Agriculture, United States Department of. *Fresh Fruit and Vegetable Audit Programs.* August 27, 2012.

quality crops can be grown for food and profit; systems that are also designed by modules so that it can be duplicated for expansion, allowing a grower to easily increase the size of the system as the business grows.

Design Services

Many of the design services that aquaponics offer are commercial services, home and community services, and school and university educational services. Commercial services offer consultation (on-site and remote), system design and development, system installation and testing, project management, feasibility assessment and risk analysis, business and financial planning, and ongoing support and maintenance. Aquaponics also offer home and community services which include consulting and advice, do-it-yourself guides and solutions, individual components to set up your own system, as well as books, DVD's, and aquaponic system plans. More recently aquaponics started offering educational services for both schools and universities that offer consultation and advice, design, supply and installation, school seminars and classroom talks, and alternative sustainable garden designs.[33] If part of the design services for architecture included integrating aquaponics early on in the schematic phase and were included

Figure 12: Global Challenge Visualization of Maa-Bara's Sustainable Technology
Source: http://images.huffingtonpost.com/2012-07-08-MaaBaravision1.gif

[33] *Japan Aquaponics.* October 5, 2012. http://www.japan-aquaponics.com/index.html (accessed October 7, 2012).

as one of the architecture services in the AIA (American Institute of Architects) forms it could potentially have many sustainable features that could correlate with making a building greener and even meet LEED (Leadership in Energy and Environmental Design) standards and criteria. Figure 12 shows a good example of a visualization of sustainable aquaponics technology that demonstrate innovative solutions with the potential to promote adoption of beneficial agricultural technologies, financial systems, and market access among smallholder farmers to improve their livelihoods in developing world's such as Nigeria; targeting areas with poor soil quality, depleted fishery stocks, and urban and natural disaster recovery zones.[34]

Sustainable Features

Aquaponics reduces the burden placed on our oceans by promoting reliant food sources like fish, it does not depend on local soil quality or acres of fertile soil like with traditional farming and may even be set up indoors with proper lighting. Aquaponics also requires 90 percent less water than conventional farming methods where most of the water is absorbed and dried up into the land, it produces up to ten times more crops in less amount of space and time than is required for traditional farming methods and uses up to 75 percent less energy that almost any other farming method. Most systems can produce year-round organic vegetables, fruits, and fish because there is no need for pesticides, fertilizers, herbicides for plants or antibiotics or hormones for the fish. If aquaponics were fully or partially integrated with architectural design and there were ways to use aquaponics in certain areas of landscaping or even serve as green roofs and walls that could aid in multiple services; edible landscaping, insulated properties, reducing heat islanding in urban areas, and so on, it would be beneficial because combined technologies of architecture and aquaponics could reduce the carbon footprint of buildings that are responsible for 39 percent of carbon dioxide (CO_2) emissions in the United States per year as seen in the chart below provided by the USGBC (U.S. Green Building Council)[35], it could minimize energy use by incorporating renewable energy technologies, offer residence the

[34] Oton, Atim. *Huffinton Post.* July 11, 2012. http://www.huffingtonpost.com/atim-oton/runo-okiomahs-maabara_b_1460468.html (accessed October 7, 2012).

[35] [8] *USGBC Buildings and Climate Change.* December 2, 2008. http://www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf (accessed October 7, 2012).

freshest food with minimal transportation, as well as provide a wide range of healthy and high value foods all year round.

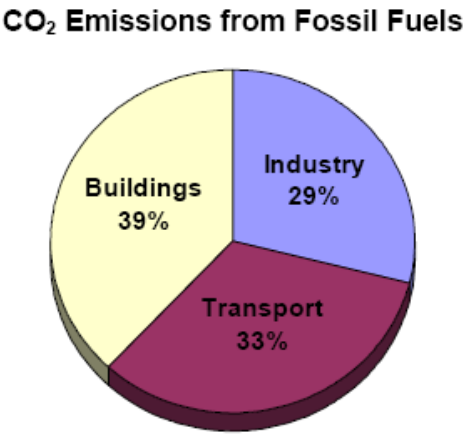


Figure 13: CO_2 Fossil Fuel Emissions Pie Chart 2012
Source: http://www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf

Commercial and residential buildings are tremendous users of electricity and only have an average lifespan of 50 to 100 years during which they continually consume energy and produce CO_2 emissions.[36] If half of new commercial buildings were built to use 50 percent less energy, it would help to save non-renewable resources annually resulting in a cleaner and healthier environment. If people invested in aquaponics through schematic and design development phases of architecture, it would help to build communities that are environmentally responsible, more profitable, contribute to reducing CO_2 emissions, decrease heat islanding, and create more comfortable and healthier places to live and work. Aquaponics can be easily used in urban areas because there is no need for a backyard or soil to grow fresh organic produce. If aquaponics systems were more widely integrated with residential designs or more specifically with tract housing development, people would no longer have to rely on buying expensive organic fruits and vegetables, or unnatural produce grown with herbicides, pesticides, or fertilizers, local production would greatly reduce food miles which is the distance food travels from where it is grown to where it is ultimately purchased or consumed by the end user, water recirculation will

[36] *USGBC Buildings and Climate Change.* December 2, 2008. http://www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf (accessed October 7, 2012).

help to reduce pollution and will use as little as two percent of the water normally needed to grow produce.[37]

If aquaponics were implemented into the American Institute of Architects (AIA) workshops and educational support could help make aquaponics more viable for architectural designs where regulations could be stated helping to popularize aquaponics to possibly be applied as part of Leadership in Energy and Environmental Design (LEED) where designers or developers could gain points towards green building design. There are many reasons for aquaponics to be applied to the professional practice of architecture including issues of population, positive environmental outlook and impacts, multitude of design services offered that continue to grow, current trends of sustainable features, lowered carbon emissions, and happy, healthy satisfied clients.

The following provides a chart of differences between conventional agriculture and aquaponics:

Conventional Agriculture	**Aquaponics**
Grows crops in soil.	Does not grow crops in soil. Grows crops in recirculated fish waste water, either on its own with the crop plants suspended at the surface in plastic net pots on floating polystyrene rafts, or suspended in the flowing water by an intert growing media fill such as expanded clay balls (Hydroton or Hydroleca brands) or pea gravel.
Uses artificial fertilizer from a natural gas (methane) or methane from oil refining feedstock.	Does not use artificial fertilizer. Nitrates dissolved in the recirculating fish water from the intensive fish farm, flowing through the grow beds or floating raft deep water containers fertilize the plants. The source of these nitrates is the ammonia excreted by the fish in the intensive tank-based fish farm part of the aquaponic recirculating aquaculture system. Aquaponics uses liquid organic fertilizer sourced via the solids removal and

[37] *Japan Aquaponics.* October 5, 2012. http://www.japan-aquaponics.com/index.html (accessed October 7, 2012).

Conventional Agriculture	Aquaponics
	mineralization section from the fish excreta. Fish excrete ammonia through their gills and a certain amount is also dissolved out of their faeces as well.
Water in conventional agriculture is used only once. 90% of it then goes to waste.	At least 90% of the water used by aquaponic systems is recirculated. Water evaporation is limited by keeping the fish tanks in the shade and covering deep water containers completely with floating white-painted closed-cell polystyrene rafts. These rafts are pierced with holes at regular intervals into which the plants in their polystyrene net pots are inserted. No surface area is permanently exposed to the heat of the sun, and the white paint further reflects heat back up into the atmosphere. This helps to keep water temperature at optimum levels for growth while stopping evaporation. Some loss does occur through evapotranspiration through the plants, however. In the University of the Virgin Islands aquaponic system water exchange is 1.5% of the total system water volume (the amount of water that has to be topped up to replace water used to flush out fish solids and to replace water loss through evapotranspiration).
Conventional agricullture only can harvest a few crops a year. Plants grow slowly in soil. In temperate climates, there is a long winter harvesting rest.	Aquaponics uses an adapted form of hydroponics to grow crops. Crops grow at up to twice the speed suspended in fertile fish waste water. They also grow at up to half the required spacing, so with crops such as basil and lettuce it is possible to get twice as many plants, twice as fast with the right varieties. Crops grown in the floating raft deep water container system can be grown conveyor-belt fashion, with seedlings being planted at one end of the hydroponic floating raft raceway as crops are being harvested weekly year-round from floating rafts at the other end. In temperate and desert climates a

Conventional Agriculture	Aquaponics
	controlled climate greenhouse is necessary to get these results year-round, however.
Conventional agriculture uses large quantities of artificial chemical pesticides.	You cannot use chemical pesticides, even the 'organic' labelled ones will kill all your fish dead fast. Since the fish it is who are running your aquaponic system, don't use chemical pesticides. Only biologically safe pest control methods can be used. These include friendly insects such as ladybugs and parasitic wasps, bacillus thuringensis, which kills caterpillars but does not affect fish or people, and vegetable oils which suffocate the pests.
Conventional agriculture uses large quantities of herbicides.	There are no weeds in aquaponics. There is nowhere for weeds to grow.
Conventional agriculture has to spend time and money and equipment on ploughing, hoeing and digging.	No digging is necessary. Everything grows in water.
A lot of money and time is spent on irrigation and watering.	Water is the growing medium and is pumped around the system constantly by a pump. No work is necessary.
Conventional agriculture uses a lot of space and land.	You only need 10% of the land space used by conventional agriculture to grow the same amount as would be grown n 90% more space in a year in soil. In many cases you can grow vastly more than that on your tiny plot. This is very intensive agriculture.
Conventional agriculture is labor-intensive.	This is automated growing. A team of two or three trained technicians are the only permanent staff you need, the rest are weekly harvesters that come in for the weekly harvest to do easy piece work.

Conventional Agriculture	Aquaponics
Conventional vegetable farmers just grow vegetables.	You have two different products being produced simultaneously here in the same space, fish and vegetables and/or soft fruit such as strawberries and melons.
Conventional agriculture requires a lot of fuel and electricity to run barns, tractors, etc.	All automated on the spot. No running around. 17% of the energy usage of a conventional farm overall.
Conventional farmers are dependent on the weather, which can wipe out profits suddenly.	In a controlled climate greenhouse, if needed due to the outdoors climate, you can control day length with low energy LED grow lamps, and control humidity, air temperature, etc. No destructive weather and pest control is easier. So the ROI on a controlled climate greenhouse is fast since you are growing when no-one else in your area can, very probably. Supplying the winter market for vegetables without the high prices of imports. Remember, low staff ratios too.

Design Documentation

Planning/Programming Criteria Guide

The purpose of the planning and programming criteria document is to determine the space requirements for a new design. The determination of space requirements is a two-phase process:

1. The development of a functional area space program, based on a given set of criteria, and driven by inputs of the type of population served.
2. The review and editing of the document produced from step one, to ensure users requirements are being met, and to examine aquaponics systems for potential efficiencies base on the user's proposed concept of operations (e.g. having enough fresh produce available on-site for users of the building, creating comfortable environments for users, etc.).

The planning and programming criteria document is intended to address the requirements of phase one – the development of functional area spaces – with an efficient and user-friendly process. Having a draft of the programs spaces will allow for the criteria document to provide functional relationship diagrams to aid in preliminary design concepts.

Project Location

The location that will be used for this project is situated in Ewa Beach, Hawaii. This projects location is in response to the State of Hawaii's current reliance on daily imported food along with the locations popular demand of tract housing development in Ewa and their recent growth in tract homes; nearby cities such as Kapolei are also experiencing this similar type of housing development. Figure 14 below shows an example of some of the tract housing development that is already existing in the Ewa regions of O'ahu.

Figure 14: Ewa Beach Track Housing Development
Source: https://maps.google.com/

Although tract housing may not be the best solution and lacks architectural design, it allows communities to be built with ease and keeps housing affordable due to the following reasons:

- Labor – Since the houses are designed the same the labor costs are lower because there's only a few designs, so houses are built faster due to similar/same structure and design layouts.
- Purchasing and transporting – The cost of purchasing and transporting is reduced because all of the tract housing is built at the same time.
- Contractors – Due to the purchasing and transporting costs being lowered, contractors are able to reduce prices and receive more work in return.[38]

[38] Staff, DoItYourself. 2011. *Tract Housing.* January 2. Accessed October 7, 2013. http://www.doityourself.com/stry/tract-housing#b.

These are just some of the reasons why tract housing caught on so fast back in the 40's and 50's, however, there are also a few disadvantages to tract housing development such as scenery; when neighborhoods are designed through tract housing they become monotonous and sometimes boring to look at because of the repetitive design from one community to the next. Another downside is the quality of tract housing, since the housing are typically built a lot faster the materials and standard quality of homes are often lowered as well.

Due to these facts, the focus of this project will aim to integrate aquaponics with current tract housing designs to show aquaponics as a viable sustainable method toward improving the ever growing trend of tract housing in Ewa.

Existing Site Information

Figure 15 provides the location of the existing site that will be used as a design base for the use of integrated aquaponics in a single-family home design. The site is conveniently located right

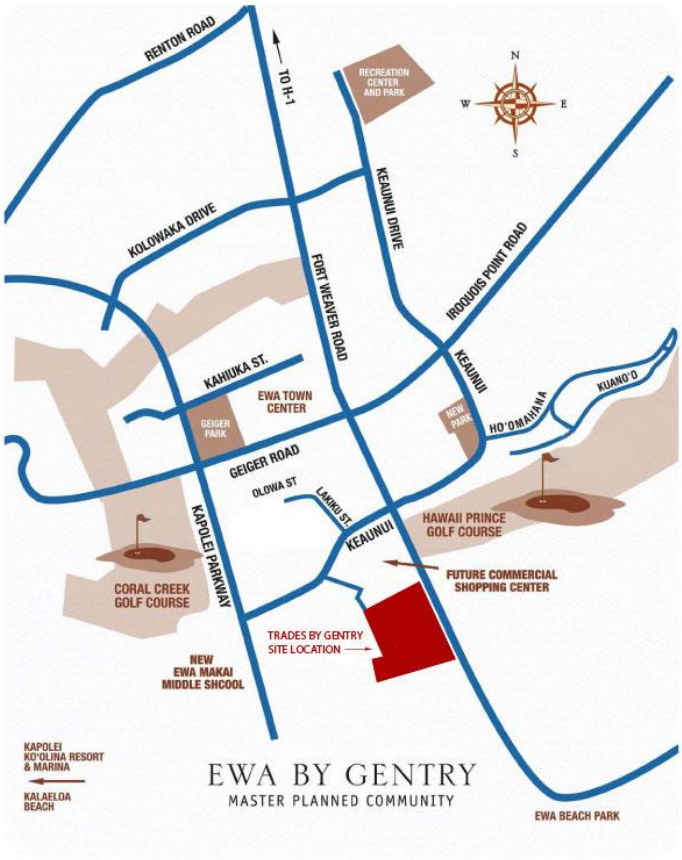


Figure 15: Trades by Gentry Location for Design Base
Source: http://www.gentryhawaii.com/uploads/images/map2011.pdf

off of Fort Weaver Road, which offers access to H-1 freeway heading north and accompanied by many nearby shopping centers, parks, schools K-12 and golf courses. The location of the site is shown shaded in red and the dashed blue line provides directions to Trades by Gentry in Ewa from Fort Weaver Road.

The easement for the site of each single family home varies, however, the typical easement for each house is provided by Ewa by Gentry's current Design Committee Rules and Regulations

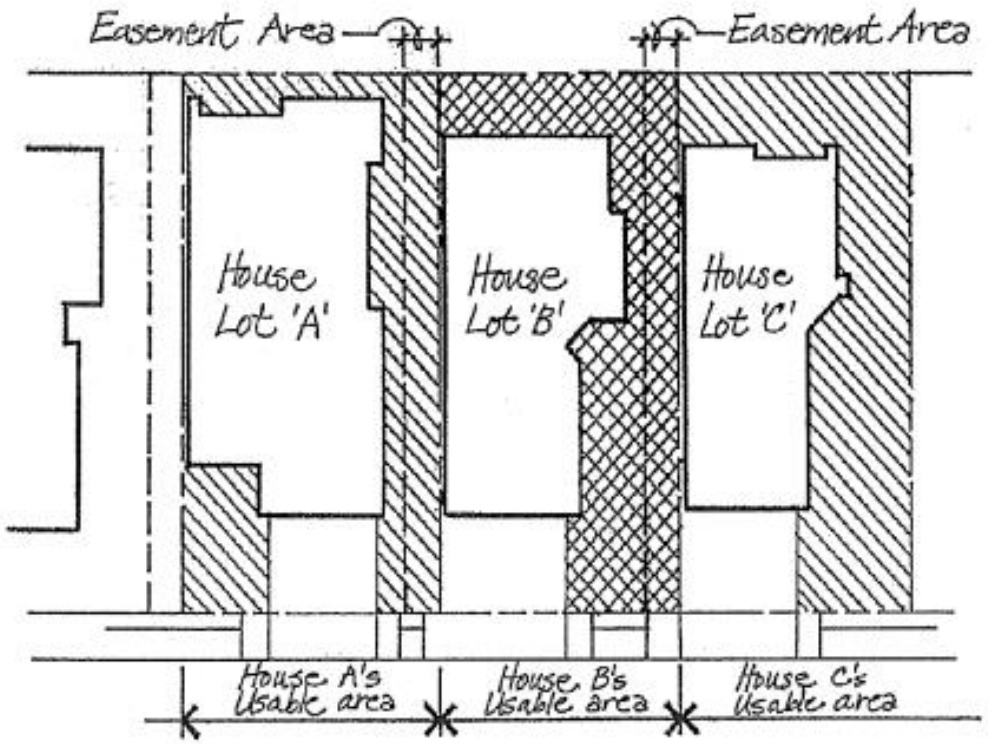


Figure 16: Maintenance Easements and Side Yard Easements
Source: http://www.ewabygentry.net/ResourceCenter/DocViewer/18467?doc_filename=design%20committee%20rules%20and%20regulations.pdf&doc_id=420856&print=1

which applies to zero lots such as Trades by Gentry. As seen in Figure 16 above, each easement area allows homeowners approximately ten feet of land to one side of their homes for light, air and landscaping.[39] (See Appendix A, Illustration 19) Since Trades by Gentry offers zero lot

[39] Regulations, Design Committee Rules and. 2013. *Ewa By Gentry Community Association Resource Center.* Accessed August 17, 2013. http://www.ewabygentry.net/ResourceCenter/DocViewer/18467?doc_filename=design%20committee%20rules%20and%20regulations.pdf&doc_id=420856&print=1. (Appendix A, Illustration 19)

designs, aquaponics will be utilized in and around easement areas of each property to create more privacy between homes, while also providing sustenance for each home through aquaponics integration.

If there are any easement alterations, the design committee rules and guidelines state that the owner must do one of the following:

1. For restrictions specific to your subdivision, the owner must refer to his and/or her deed. For answers to any questions or clarification, all the Ewa by Gentry Office.
2. Any mechanical improvements (a/c compressor, pool equipment) will automatically be denied.
3. Inert improvements (gravel, slabs, walkways, etc.) require termite treatment. Any improvements intended to be built on or within an easement must be accompanied by a Neighbor's Awareness Form from the homeowner affected by the improvement. This includes party fences within easement as well. These rules apply to all easement alterations.[40]

Due to the committee's rules and guidelines, the integration of aquaponics for each home will not be designed with the need for any easement alterations; therefore, any rules and guidelines referring to this specific tract housing development will not have to adjust to maintenance and/or side yard easement changes.

Development Rules and Regulations

The current rules and regulations related to having aquaponics systems on the property lot is in the *Design Committee Rules and Guidelines, Section 16: Water Features, Water Falls and Fishpond Structures* state that approval is required by the Design Committee for any fishponds, water features, and structures on or in any part of each lots usable area which is shown in Figure 14. For approval, the water feature, waterfall, or fishpond structure must comply with the following, as stated in the Design Committee Rules and Regulations:

[40] Regulations, Design Committee Rules and. 2013. *Ewa By Gentry Community Association Resource Center.* Accessed August 17, 2013. http://www.ewabygentry.net/ResourceCenter/DocViewer/18467?doc_filename=design%20committee%20rules%20and%20regulations.pdf&doc_id=420856&print=1.

A. *Maximum Dimensions:*

   a. *Depth: Sixteen (16) inch maximum water depth.*

   b. *Height: Counting the distance from the top of the structure, with all cascading waterfalls, urns, statues, and static displays, the heights are as follows:*

      i. *Front Yard: Total maximum allowable height shall be limited to thirty (30) inches.*

      ii. *Back Yard: Total maximum allowable height shall be limited to six (6) feet in height.*

   c. *Width: A surrounding edging or concrete coping shall be limited to a maximum width of thirty-six (36) inches.*

B. *Location: Water feature structures are required to be located outside of the five (5) foot setback area from each side and back property lines, and ten (10) feet from the front of property lines.*

C. *Accessories: All feeding boxes, water supply lines, cleanouts, and filters shall be concealed from view.*

D. *Lighting: All ground lighting shall follow the lighting rules (refer to rule #37)*

E. *Shading: Shade cloths over the fishpond shall not be approved for the front yard.*

F. *Water Disbursement: Rain overflow water shall be contained within the boundaries of the property.*

   a. *Exception: A stand-alone fountain with a maximum height of six (6) feet, located in the backyard, and not visible from the street or neighboring properties, may be installed without a Design Permit.*

   b. *A water feature, incorporated into a Concrete Rock Masonry (CRM) moss rock wall or natural free-standing waterfall that exceeds a height of thirty (30) inches is not permitted within the setback areas.*[41] (See Appendix A, Section X)

[41] Regulations, Design Committee Rules and. 2013. *Ewa By Gentry Community Association Resource Center.* Accessed August 17, 2013. http://www.ewabygentry.net/ResourceCenter/DocViewer/18467?doc_filename=design%20committee%20rules%20and%20regulations.pdf&doc_id=420856&print=1. (Appendix A, Section X)

Due to the current rules and guidelines, the design of integrating an aquaponics system with each home will follow these parameters to the fullest with allowing room for growth, such as increasing grow beds or fishpond in the future.

Ewa Building Codes, Zoning and Ordinances

The Ewa building codes are listed under *Other Codes, Laws, Rules and Ordinances* in the *Ewa by Gentry Community Association, Design Committee Rules and Regulations Manual*. The specification states that it is the owners' obligation to comply with all existing laws, ordinances, rules and regulations, and as may be amended, or heareafter made by any governmental authorities or with such terms and conditions required under the Master Declaration of Ewa by Gentry, or any deed, easements, lease, or mortgage.[42] (See Appendix A, Section VII)

In any cases of conflict, more stringent requirements must be followed through the State Building Codes, International Building Codes (IBC) and Land Use Ordinance (LUO).

[42] Regulations, Design Committee Rules and. 2013. *Ewa By Gentry Community Association Resource Center.* Accessed August 17, 2013. http://www.ewabygentry.net/ResourceCenter/DocViewer/18467?doc_filename=design%20committee%20rules%20and%20regulations.pdf&doc_id=420856&print=1. (Appendix A, Section VII)

Proposed Building Design

Figure 17 shows four Trades by Gentry model homes options that include, Aheahe, Makini, Kai ā ulu, and ‘Olu‘olu. Each design offers various bedroom, bath and total living areas along with backyard covered lanai options.

Figure 17: Trades by Gentry Model Homes
Source: http://www.gentryhawaii.com/uploads/TradesBrochure.pdf

For this project, the Aheahe plan one option will be used as a design base to show how sustainable methods such as aquaponics could be used to improve the future of current tract housing developments in Hawai’i. Figure 13 shows a detailed image of Aheahe, including first and second floor plans with the covered lanai options. This floor plan will be used as a design base to show how aquaponics could be easily integrated to work with current tract home designs, offering current and future home owners the option of including an aquaponics system with their home.

Although the project location is in Ewa Beach, Hawai’i, the main focus of this project is integrating aquaponics as a sustainable option with current tract home designs, allowing users to maintain a healthy source of produce and fish for themselves and their families. With this, future architects, owners and developers could use aquaponics as a design base for future tract housing development in similar locations such as Hawai’i.

Figure 18: Aheahe - Plan 1 existing floor plans
Source: http://www.gentryhawaii.com/index.php?page=aheahe

Trades by Gentry Aheahe design offers three bedrooms and two and a half bath with a total living area of 1,151 square feet. Although the Makani layout is said to be the most popular of the four plans with one of the largest total living areas available, aside from the ʻOluʻolu, the Aheahe plan one option, smallest of the four plans, was chosen due to the following:

- The United States Census Bureau indicates that the average American house size is 2,169 square feet.[43] However, the average size of a typical home has been continually decreasing since 2007, right before the housing crash. Prior to this, houses used to average 2,277 square feet.

- Trades by Gentry homes are significantly smaller than the average American house, however, using a smaller tract home as a design base could show how aquaponics can be implemented for smaller single family homes so it targets a wider range of home types, not only in Hawai'i, but also in other locations where the average size of a home is much larger.

[43] Admin, WordPress. 2012. *Average Square Feet for a House in America.* January 30. Accessed October 3, 2013. http://www.smalltinyhouse.com/average-square-feet-for-a-house-in-america/.

Schematic Building Design

The former schematic sketch design of aquaponics integrated with architecture is shown in Figures 19 and 20 as an example process of how aquaponics can be used as a method to provide sustainable options for tract housing development in Hawai'i.

Linear Step Aquaponics System:

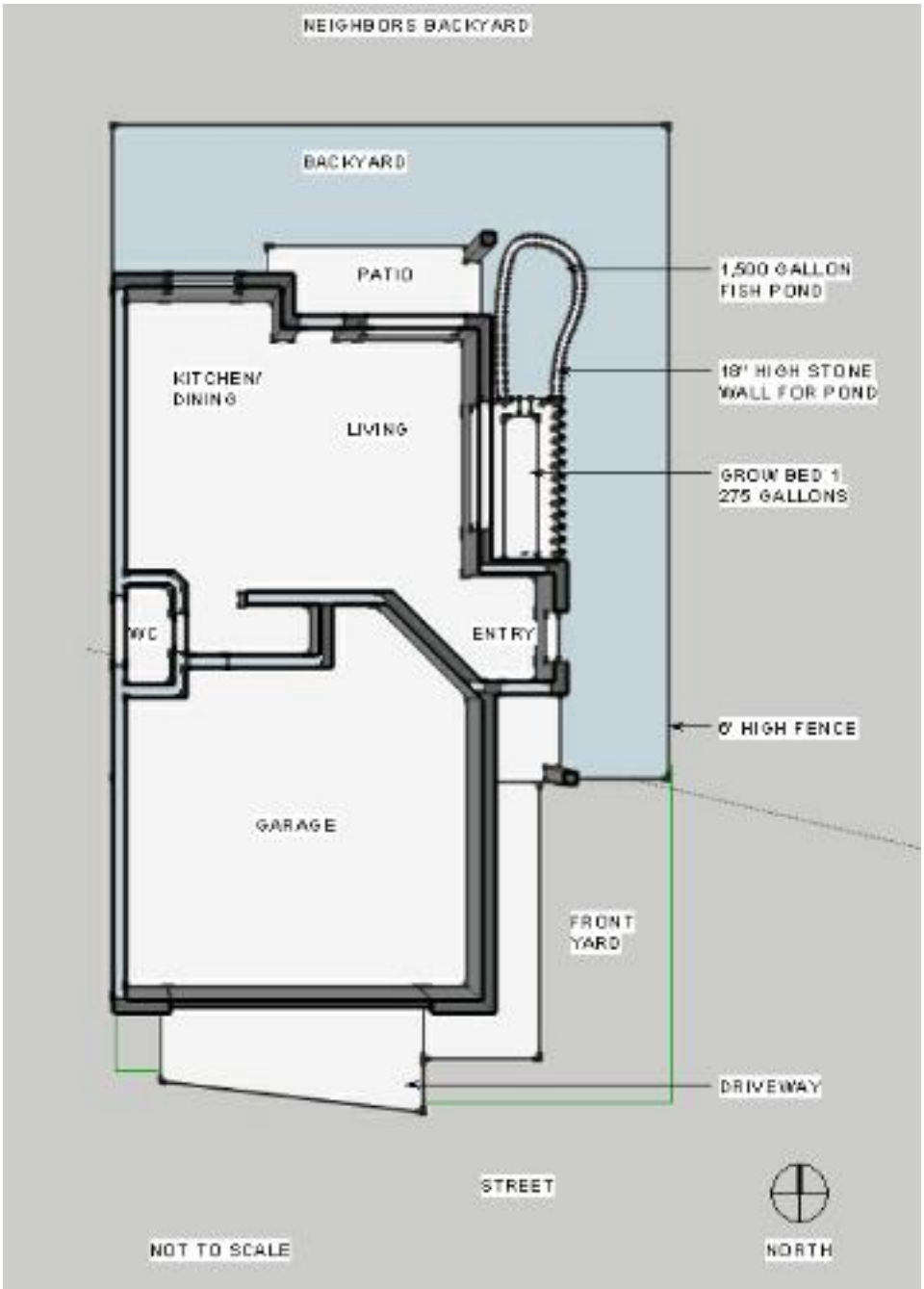


Figure 19: First Floor Plan

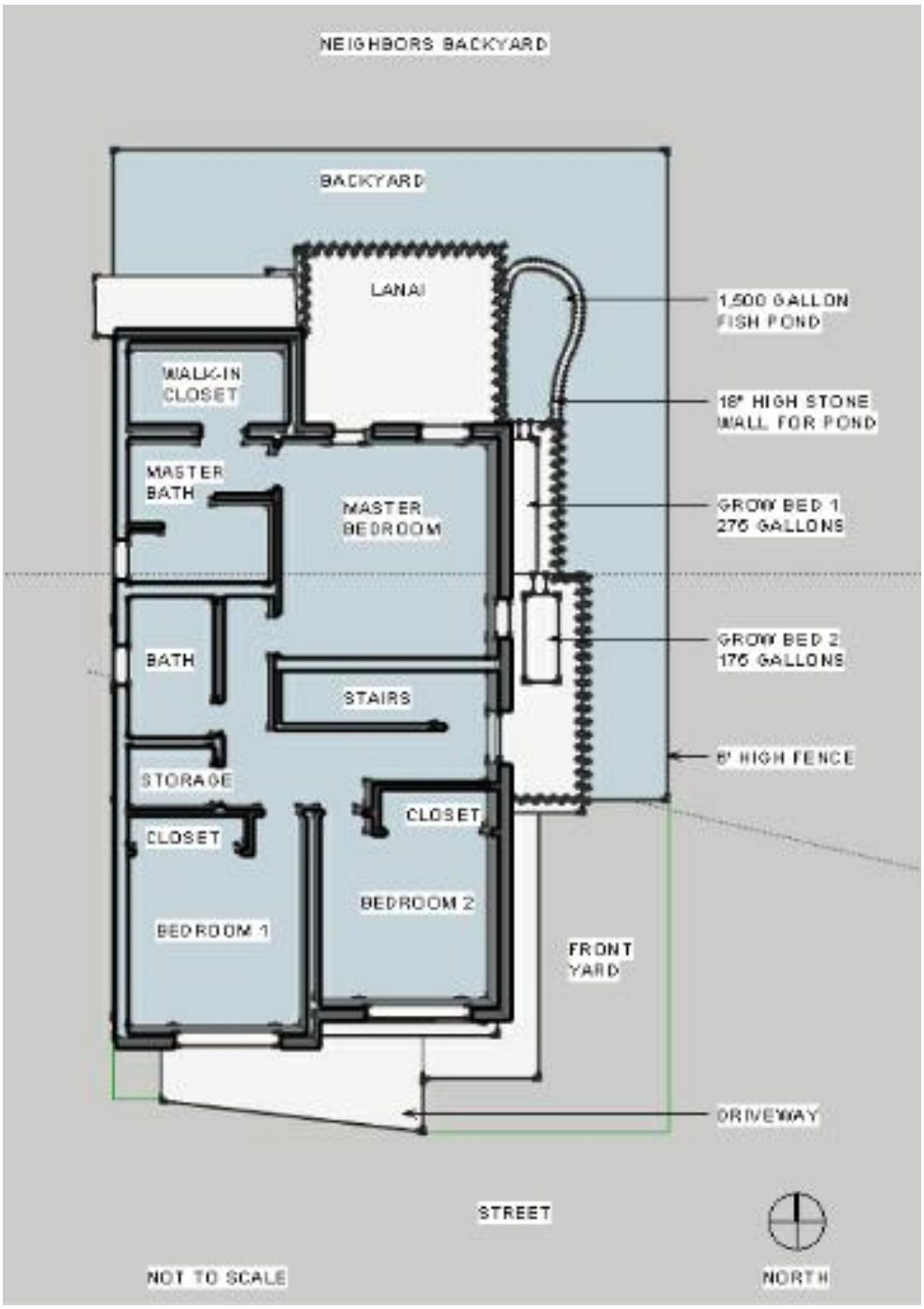


Figure 20: Second Floor Plan

As seen in Figures 19 and 20, the interior layout of the original Trades by Gentry, Aheahe plan has not changed, showing that an integrated aquaponics system is possible without affecting the total living area of the home and without inflicting on or altering any of the easements provided for each home.

The main concept for the design of this Linear Step Aquaponics System was to create a wall of water that integrated mini waterfalls between each home to help create more privacy for families since the layout of each home is on zero lot properties. Therefore, grow bed two, as shown in Figure 19, uses the entry area of the home as a partial green roof/lanai for planting fruits, veggies and/or other medicinal plants. Grow bed two focuses on creating a planting area for plants that require heavy nutritional value, such as lettuce, kale, peppers, tomatoes and squash, since the return pump from the fish pond will originate here first. Grow bed one, however, creates a place for plants that require much less nutritional value, like soy beans, swiss chard, onions and leeks, since the return water for grow bed one will be receiving pre-filtered water from grow bed two. From there, the clean water is then returned back to the fish pond, as shown in Figures 19 and 20 above.

As a note, the backyard is completely enclosed by a required six foot high fence, which is included as part of the original design and required by International Building Code (IBC), Chapter 31, Section 3106[44] (See Appendix B) for safety purposes of any water source that could result in drowning, especially for children.

The following lists some of the benefits that the Linear Step Aquaponics System provides:

- Generates natural aeration of water from two mini waterfalls
- Path of waterfall helps to distribute nutrients to all plants and keep water consistently moving with gravity
- Waterfall creates noise barrier between homes and helps to create more privacy on smaller zero lot properties.

The Linear Step Aquaponics System also has some drawbacks including:

- Plants only accessible with ladder, difficult for facility support maintenance to access.
- Fishpond is too exposed and water will have to be maintained daily due to algae growth.
- Grow bed layout does not allow for vine planting; growing tomatoes and strawberries will be difficult without extra support if the homeowner prefers this type of produce.

[44] Council, International Code. 2011. *2012 International Building Code.* Country Club Hills: International Code Council, Inc. (Appendix B, Section 3106)

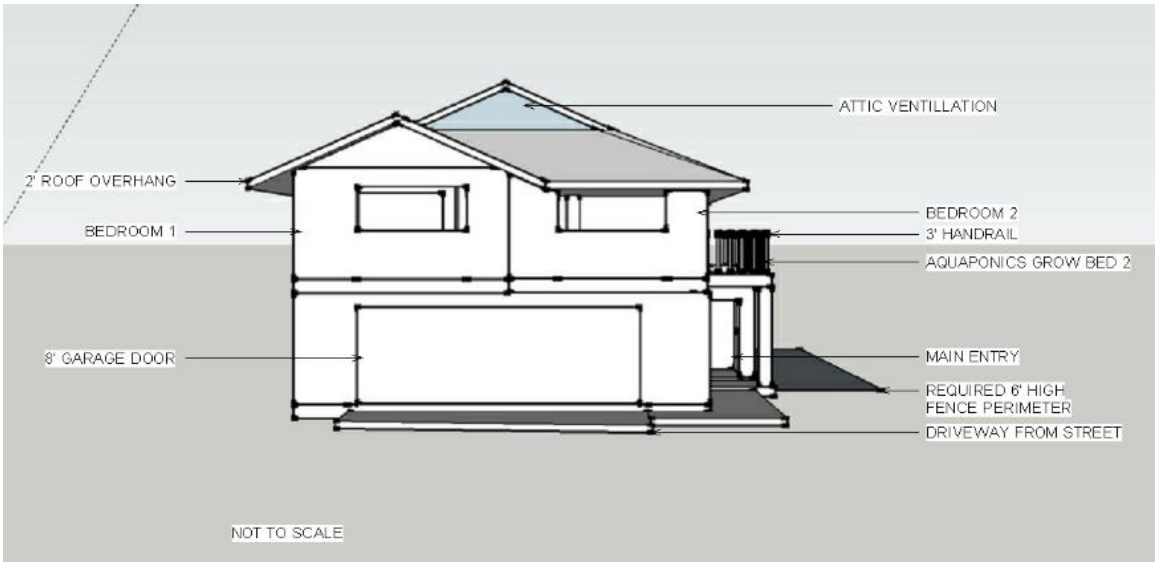


Figure 21: South Elevation

Figure 21 above shows a south elevation of the Linear Step Aquaponics System. This elevation shows the entrance to the garage from the driveway and the main entry to the home from the front yard on the right. The required six foot high fence perimeter is partially visible from the street, as well as the aquaponics grow bed 2 above the main entry. The south elevation also provides an opening for the attic ventilation which will help to keep the house cooler, compared to the original roof design that has the same roof type without the functional ventilation for the attic. Figure 22 shows the north elevation of the home design which provides views from the backyard. This elevation clearly depicts the waterfall design concept on the left side of the house that illustrates the depth and height between the two aquaponics grow beds and fish

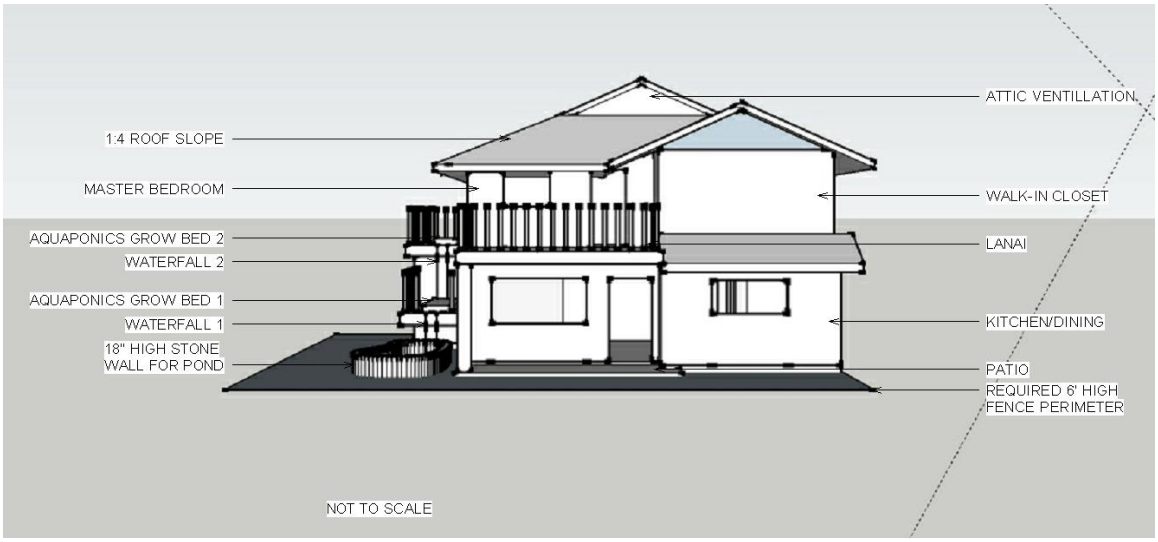


Figure 22: North Elevation

pond. Waterfall 2 on the upper (highest) level provides a six foot drop where waterfall 1 provides a shorter three foot drop from grow bed 1 to the fishpond below. The clearest illustration of the overall Linear Step Aquaponics System design is provided in Figure 22 and 23. The overall home design from the front yard to the backyard is shown in east elevation (Figure 23) which fronts a neighbors home similar to what is shown in Figure 24. The west elevation provides the least amount of information and contains required windows for the two bathrooms on the second floor and the water closet on the first floor in order to provide more privacy for the yard on the opposing side of the wall.

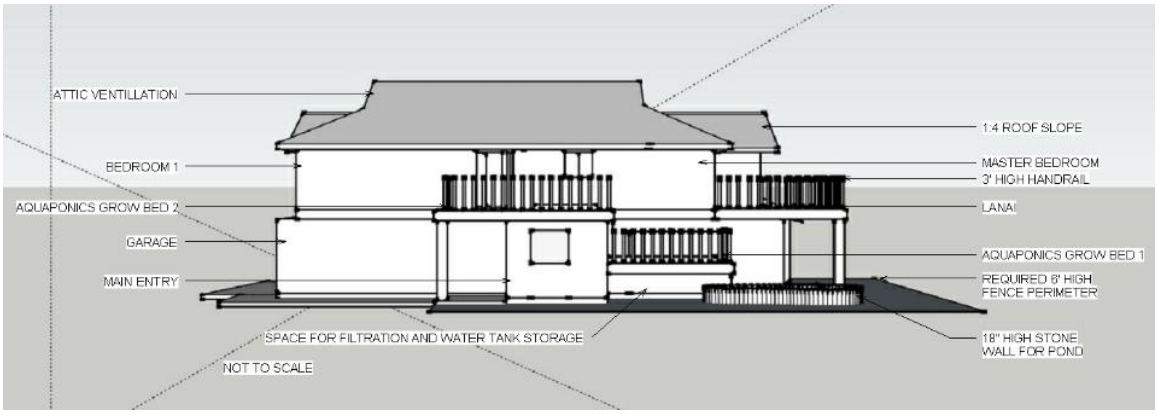


Figure 23: East Elevation

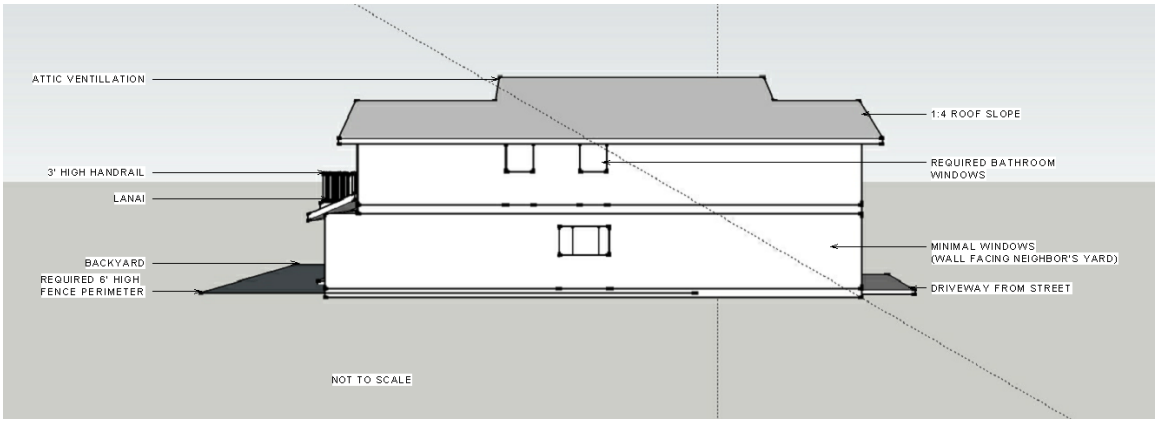


Figure 24: West Elevation

Figure 25: Northeast Perspective View

The perspective view shown in Figure 25 illustrates a detailed understanding of how the Linear Step Aquaponics System works together with the existing Trades by Gentry Aheahe design layout that provides minimal changes to the roof above the entry. The original roof above the main entry contains a hip roof ratio of one to four, however in the Linear Step Aquaponics System integration, the hip roof was altered to provide a flat "green" roof (grow bed space) with partial lanai for maintenance and views. This allowed the option of having two different grow beds (high and low plant nutrient needs) of optional sizes.

Vertical Trellis Aquaponics System:

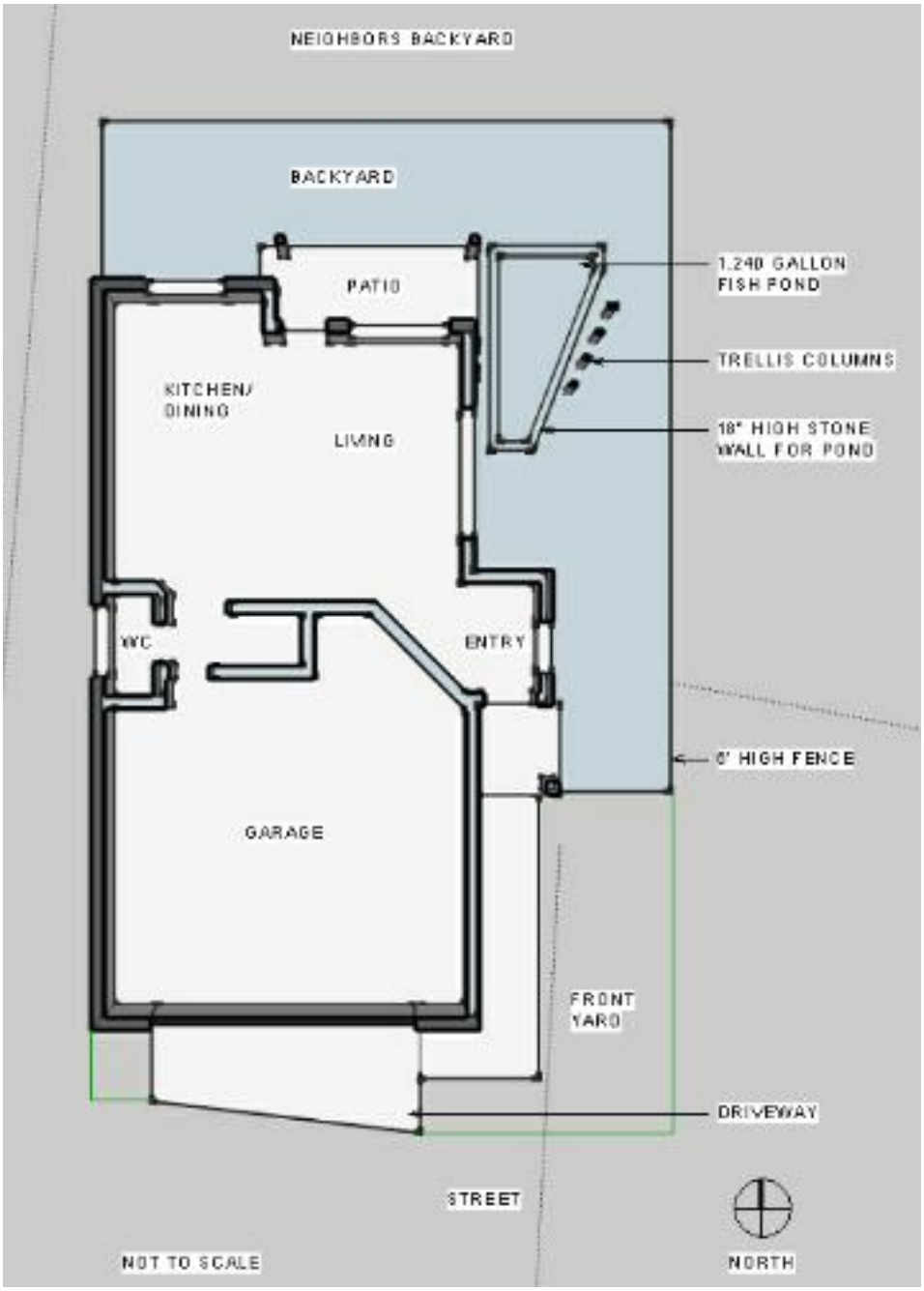


Figure26: First Floor Plan

The Vertical Trellis Aquaponics System design as seen in Figures 26 and 27, has not changed the interior layout of the original Trades by Gentry, Aheahe plan, showing another design option besides the Linear Step Aquaponics design that allows an integrated aquaponics system to work without affecting the total living area of the home and without inflicting on or altering any of the easements provided for each home.

The main concept for the design of the Vertical Trellis Aquaponics System was to create a trellis system that uses the same structure beam from the roof on the second level, while also creating more privacy for families on the upper lanai and living area on the lower level, since the layout of each home is on zero lot properties. This design focuses on using part of the lanai on the second floor for planting fruits, veggies and/or other medicinal plants. Currently this design option accommodates for two 3 x 5 grow beds that are located below the trellis to provide extra shading for plants; particularly younger plants and plants that require lots of shading. The trellis also provides additional support for plants such as tomatoes, green beans and eggplant.

Figure 27 illustrates the 1,240 gallon fish pond on the first level next to the patio that receives the clean filtered water from the two grow beds provided on the second level lanai above. The trellis helps to connect the two entities and bring together gathering spaces that provide more privacy through the plants and trellis on the second level and the waterfall sounds on the ground level next to the patio outside the living area.

As noted on the previous linear step design, the backyard is completely enclosed by a required six foot high fence, which is included as part of the original design and required by International Building Code (IBC), Chapter 31, Section 3106[45] (See Appendix B) for safety purposes of any water source that could result in accidents such as drowning.

The following lists some of the benefits that the Trellis Aquaponics System provides:

- Generates natural aeration of water from waterfall on the ground level.
- Trellis design uses same structural beams as the roof so special materials/colors will make ordering materials easier.
- Waterfall creates noise barrier between homes and helps to create more privacy on smaller zero lot properties.
- Integration of trellis system allows plants that need additional support, such as tomatoes and/or be grown since the same system will be used from second to ground level.

[45] Council, International Code. 2011. *2012 International Building Code.* Country Club Hills: International Code Council, Inc. (Appendix B, Section 3106)

The Trellis Aquaponics System also has some drawbacks including:

- Plants only accessible on second floor lanai through master bedroom.
- Although this design provides a shading trellis system the fishpond is still too exposed and water will have to be maintained daily due to algae growth.

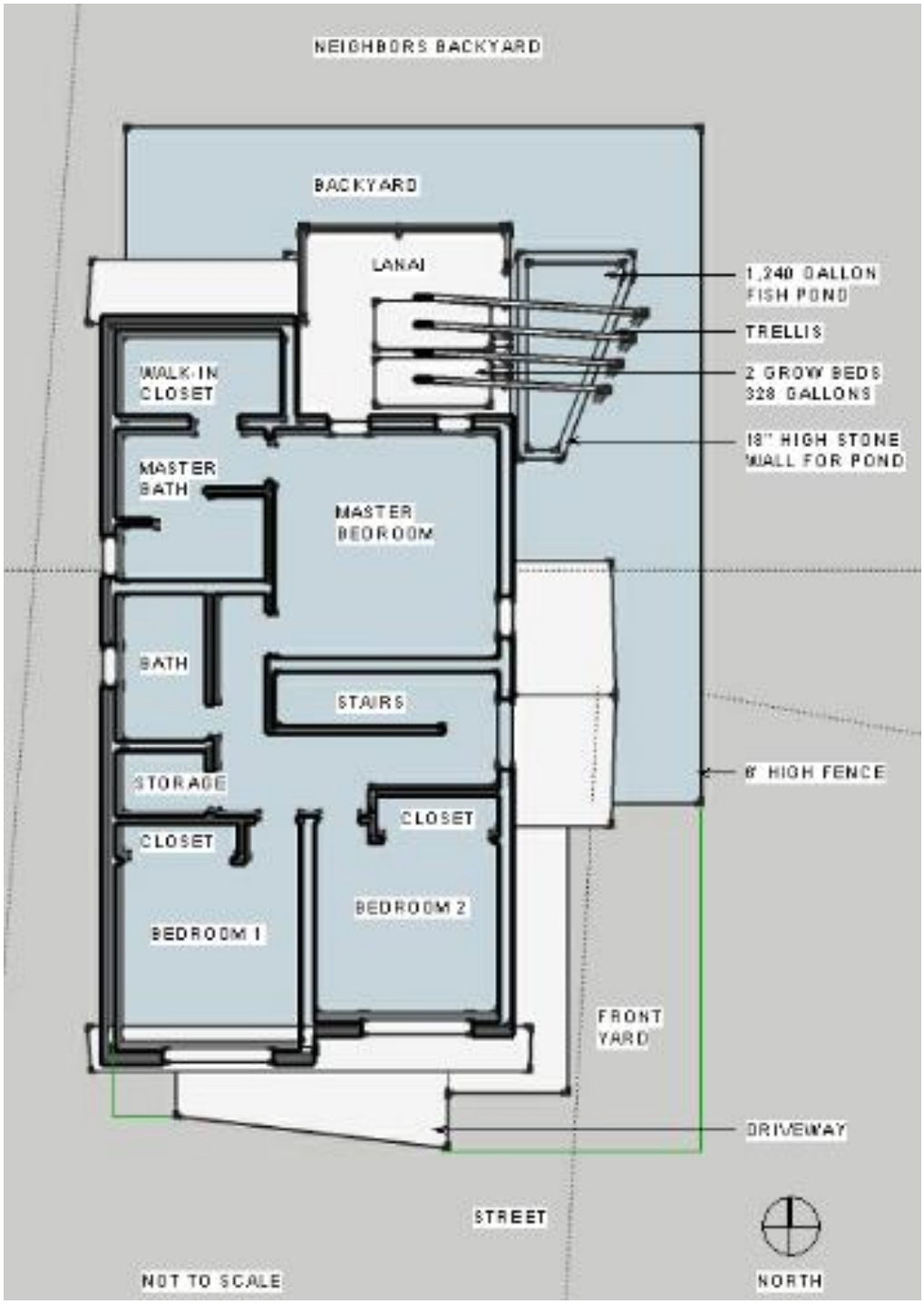


Figure 27: Second Floor Plan

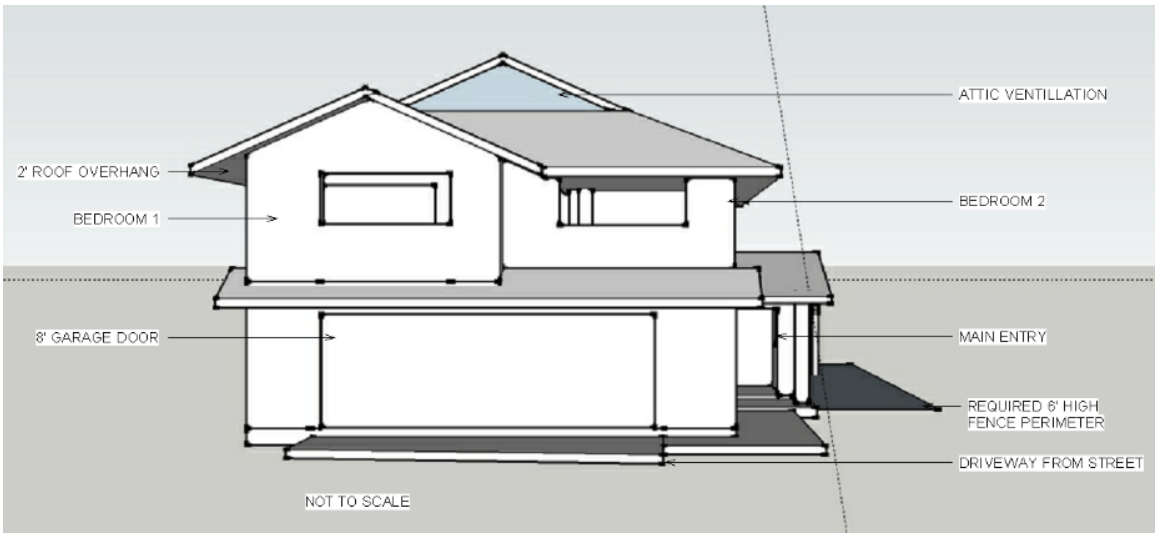


Figure 28: South Elevation

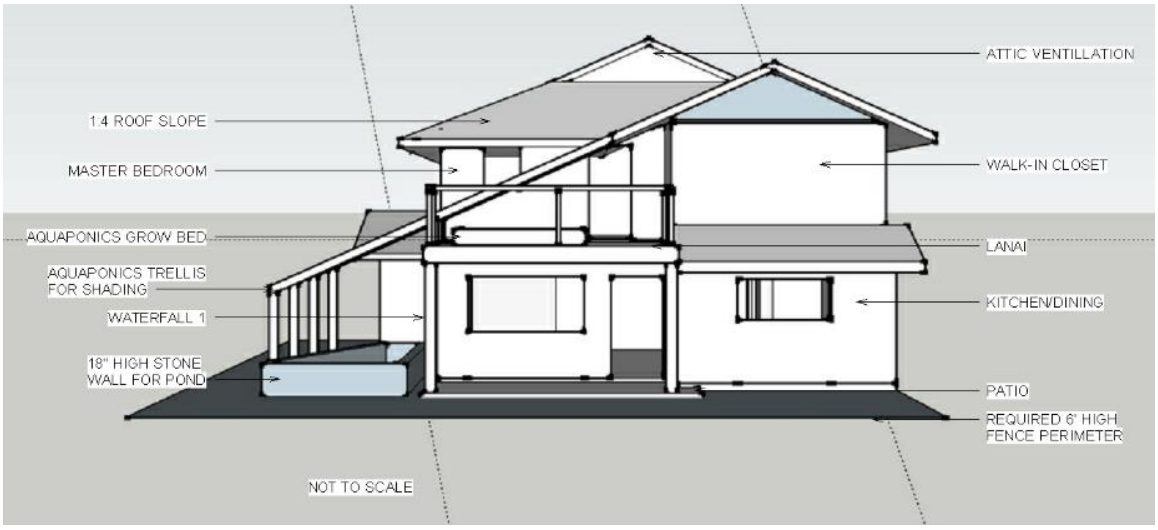


Figure 29: North Elevation

Figure 28 above shows a south elevation of the Trellis Aquaponics System design. This elevation shows the entrance to the garage from the driveway and the main entry to the home from the front yard on the right. For this trellis design, the required six foot high fence perimeter is partially visible from the street, however the aquaponics system is only visible from the north elevation and east elevation as shown in Figure 29 and 30. Figure 29 shows the north elevation of the homes design, which clearly shows the trellis design concepts depth and height between the grow beds on the second floor lanai and the ground floor fish pond.

The image of the overall Trellis Aquaponics System design is best shown in Figure 29 and 30. The overall home design from the front yard to the backyard is shown in Figure 30, east elevation which fronts a neighbor's home similar to what is shown in Figure 31. The west elevation provides the least amount of information and contains required windows for the two bathrooms on the second floor and the water closet on the first floor in order to provide more privacy for the yard on the opposing side of the wall.

Figure 30: East Elevation

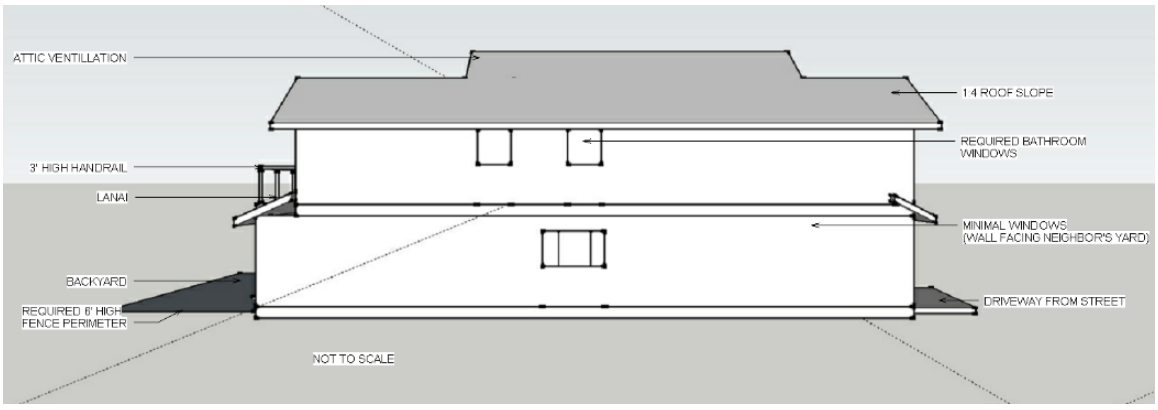


Figure 31: West Elevation

Similar to the Linear Step Aquaponics Design the perspective view shown in Figure 25 illustrates a detailed understanding of how the Trellis Aquaponics System works together with the existing Trades by Gentry Aheahe design layout that provides minimal changes to the roof above the entry. The original layout contains an open lanai, however in the Trellis Aquaponics System Design, the integration used part of the lanai for the grow beds and used the same beam structure of the roof above the walk-in closet which contains a hip roof ratio of one to four. This structure is extended on the left side (east elevation) to the ground level to provide support and shading for the plants and fishpond.

Figure 32: Northeast Perspective View

This design also helps to aerate water naturally through the waterfall, however unlike the Linear Step Aquaponics System with a short falling distance, the height of the waterfall distance from grow bed to fishpond is close to seven feet, which creates the need for controlling the splash of water so that the evaporation rate of water is reduced.

Final Building Design

Linear Step Aquaponics System:

The following are drawings of the final building design for the Linear Step Aquaponics System. Figure 33 below shows the site plan drawings for the Linear Step design, which has changed from the schematic model in terms of function. Grow bed 2 can now be accessed from an

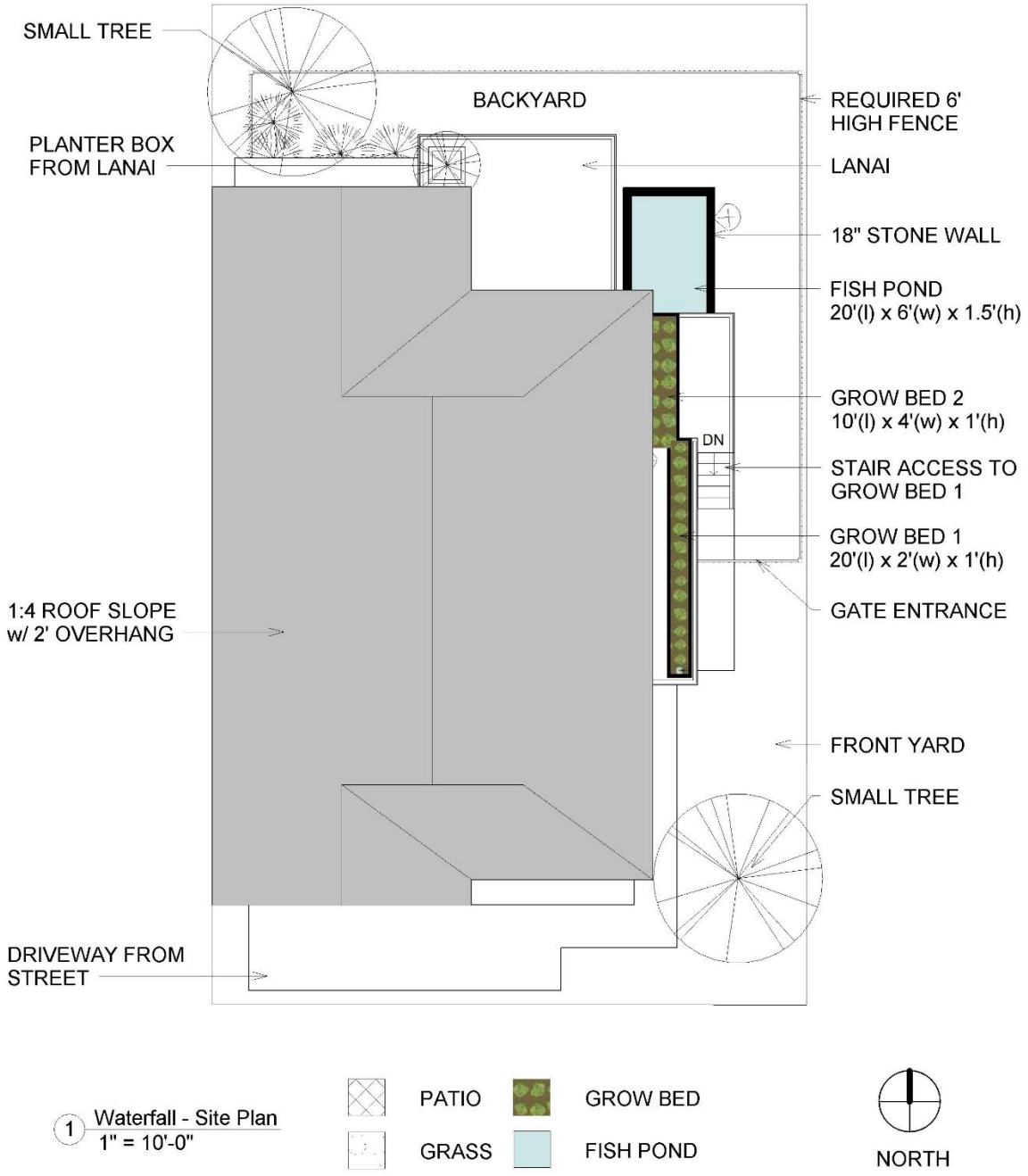


Figure 33: Site Plan for Linear Step Aquaponics

intermediate lanai that can be reached from the added stair through the private gate entrance located to the right side of the home, as seen in Figure 33 and 34. As mentioned previously, grow bed 1 is designed for plants that require high nutrient levels because it is receiving the unfiltered fish pond water, whereas grow bed two allows for plants that only require a low

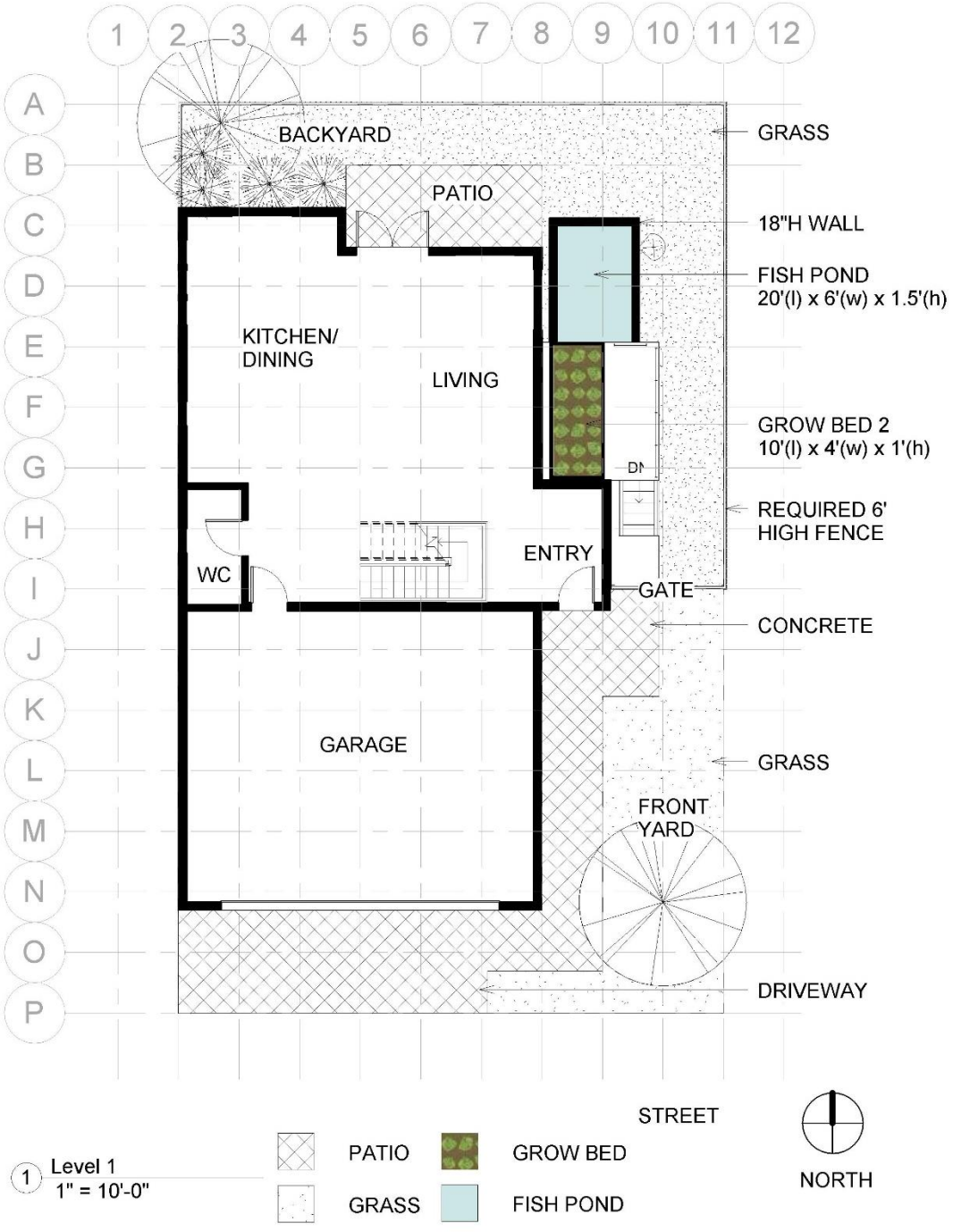


Figure 34: First Floor Plan for Linear Step Aquaponics

nutrient level since it is receiving pre-filtered water from grow bed one. This linear step design allows for the homeowner to have a variety of different plants that require various nutrient levels. The stepped waterfall also helps to aerate the water through a natural flowing system while helping to control the splash between levels of grow bed and fish pond reducing the overall evaporation rate of the water required.

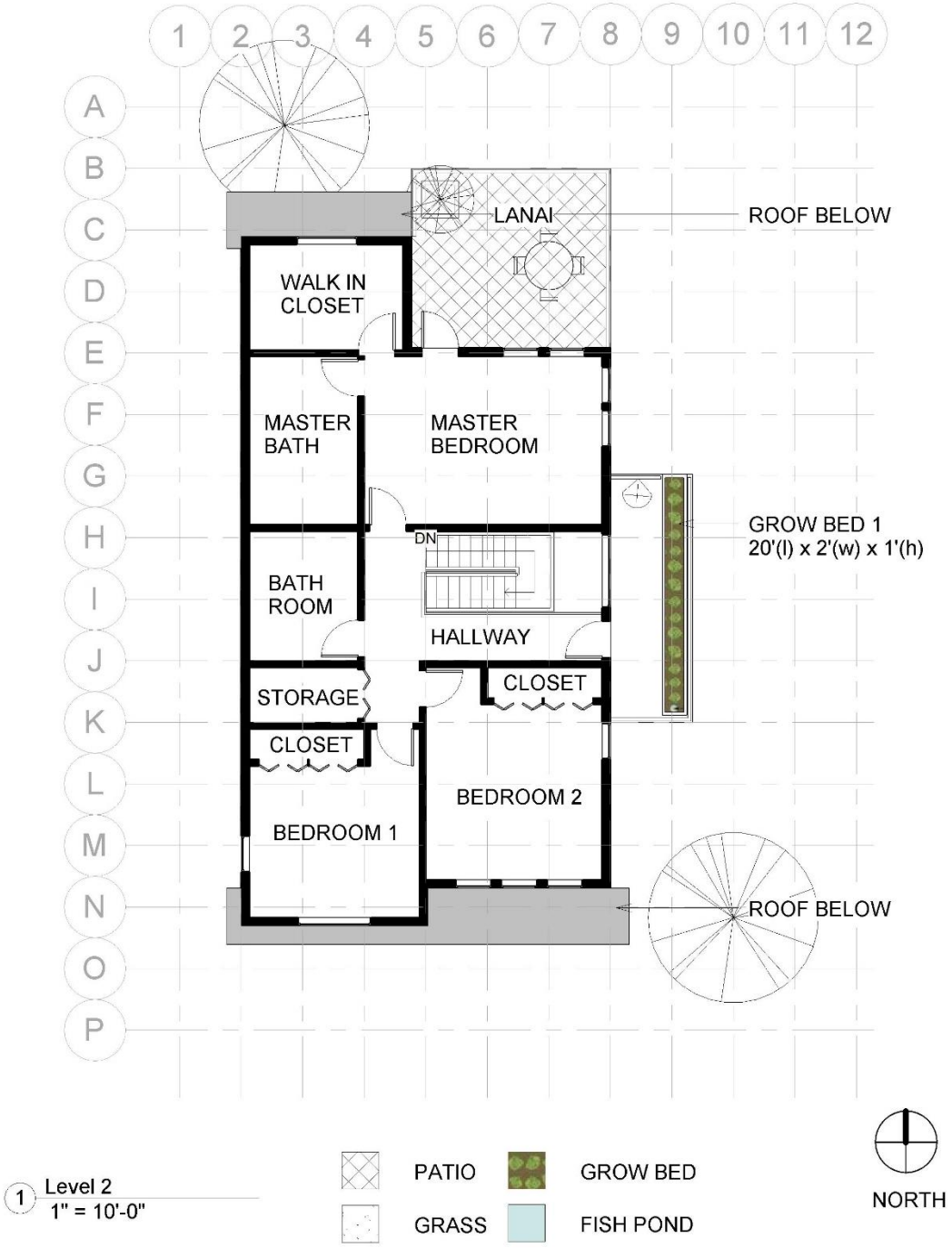


Figure 35: Second Floor Plan for Linear Step Aquaponics

The first floor plan in Figure 35 clearly shows the location of grow bed two and the fish pond which helps to provide as a noise barrier from nearby streets and neighbors due to the zero lot sites between homes. The grow beds extend one level further on the second floor above the main entry as seen in Figure 35 on the previous page. Grow bed one offers homeowners and their families the option of also growing medicinal plants that are difficult to grow in the ground because of the soils lack of nutrients. Dr. Bradley K. Fox, Assistant Extension Specialist for Aquaponics/Aquaculture at the College of Tropical Agriculture and Human Resources under the Department of Molecular Biosciences and Bioengineering,[46] at the meeting on November 21, 2013, mentioned that "aquaponics offers users the opportunity to grow their own 'medicinal rack' such as 'Olena which is difficult to find in Hawai'I today"[47]

The interior floor plan of the original Aheahe layout has changed the function of the home, which can be seen in Figure 35 on the second floor plan. A hallway is provided between the stairs and bedroom two in order to provide an area to walk out above the main entry on the ground level, so that the user has direct access to grow bed one on the second level of the home. For this new design layout, the master bedroom and bedroom two had to accommodate about 60 square feet per room to make room for the hallway area.

[46] Smith, Jody. 2013. *Sustainable and Organic Agriculture Program.* June 20. Accessed November 25, 2013. http://www.ctahr.hawaii.edu/sustainag/leaders/fox.html.

[47] Fox, Bradley K., committee meeting 4 to Gina Takahashi, November 21, 2013.

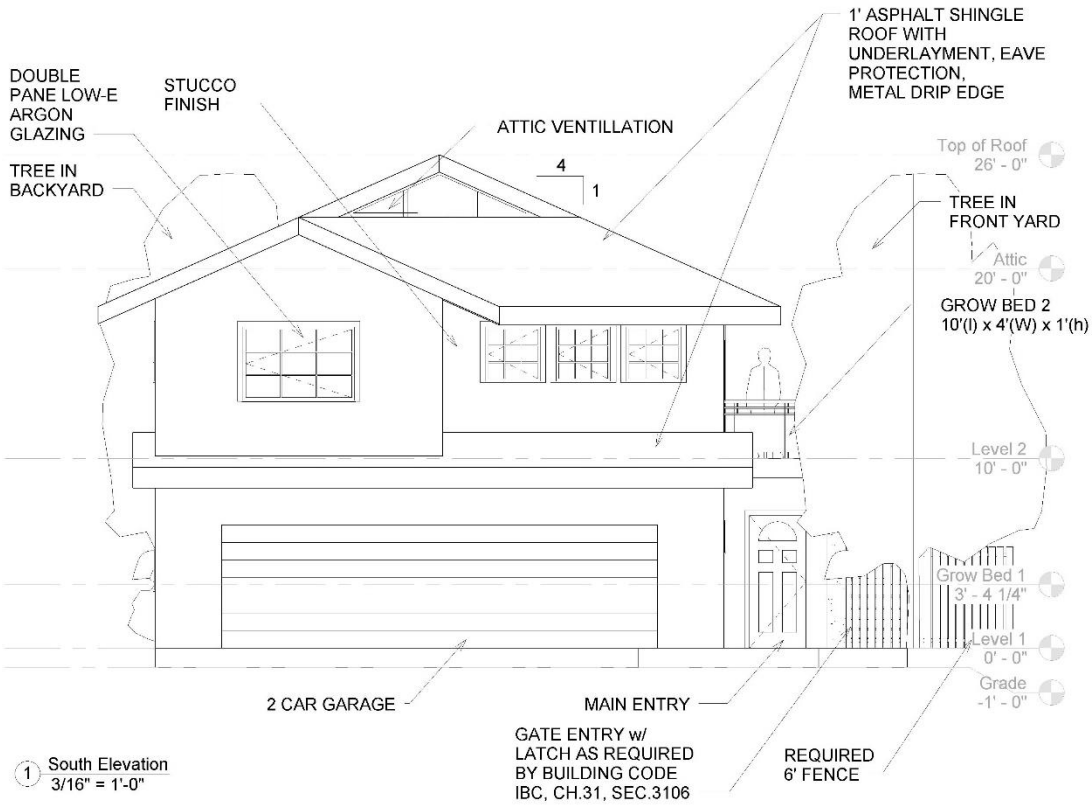


Figure 36: South Elevation for Linear Step Aquaponics

Figure 37: Rendered South Elevation for Linear Step Aquaponics

Figure 36 on the previous page provides a south elevation for the Linear Step Aquaponics design, which offers attic ventilation on the highest part of the roof that has a one to four ratio slope with one inch asphalt shingles, underlayment, eave protection, and a metal drip edge. The home also has a stucco finish with double pane low-e argon glazed windows that help to keep the house cooler throughout the day. Grow bed two is partially visible and provides approximately 40 square feet of growing area for plants and produce. The gate entry has a latch that is required by building code, chapter 31, section 3106 in response to the 18 inch high fishpond in the backyard. (See Appendix B, Section 3106) Figure 37 also offers a rendered south elevation for the Linear Step Aquaponics design so that the drawing and render could be used as a reference to one another to help in understanding the overall layout and look of the Linear Step Aquaponics System design option.

On the next few pages, Figure 38 and 40 provides additional information regarding the aquaponics system size and location. As seen in the north elevation of Figure 38, the aquaponics linear step design is located to the left of the home allowing users to use the yard directly alongside the east elevation without having to alter current easement rules and regulations. Figure 39 helps to show a rendering of what the home would look like in response to materials and details noted in Figure 38 and 40.

As stated previously in the schematic design, waterfall 2 on the upper level provides a six foot drop where waterfall 1 provides a shorter three foot drop from grow bed 1 to the fishpond below. The clearest illustration of the overall Linear Step Aquaponics System design is provided in Figure 38 and 40 on the following two pages. The overall home design from the front yard to the backyard is shown clearly in Figure 40, east elevation which fronts a neighbor's home similar to what is shown in Figure 42.

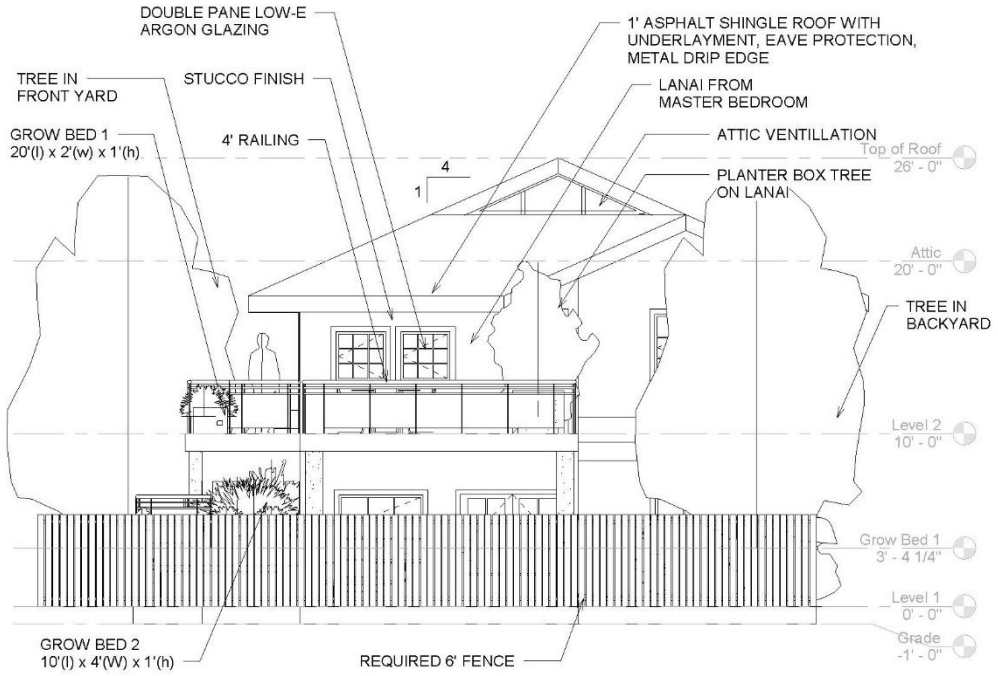


Figure 38: North Elevation for Linear Step Aquaponics

Figure 39: Rendered North Elevation for Linear Step Aquaponics

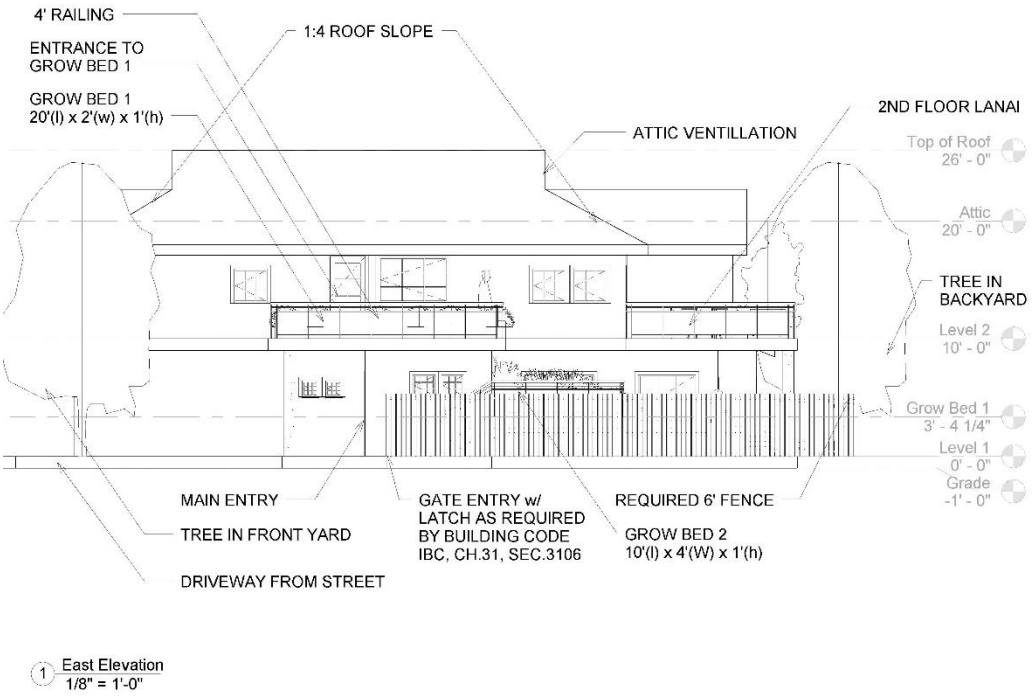


Figure 40: East Elevation for Linear Step Aquaponics

Figure 41: Rendered East Elevation for Linear Step Aquaponics

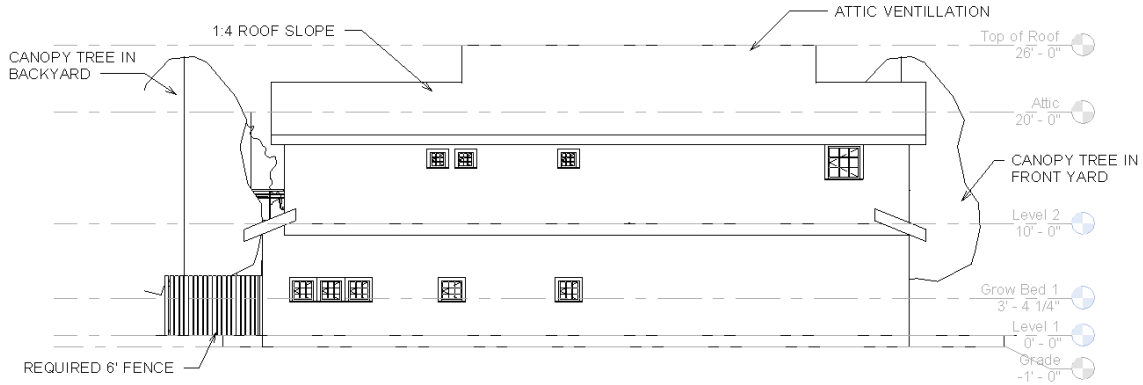


Figure 42: West Elevation for Linear Step Aquaponics

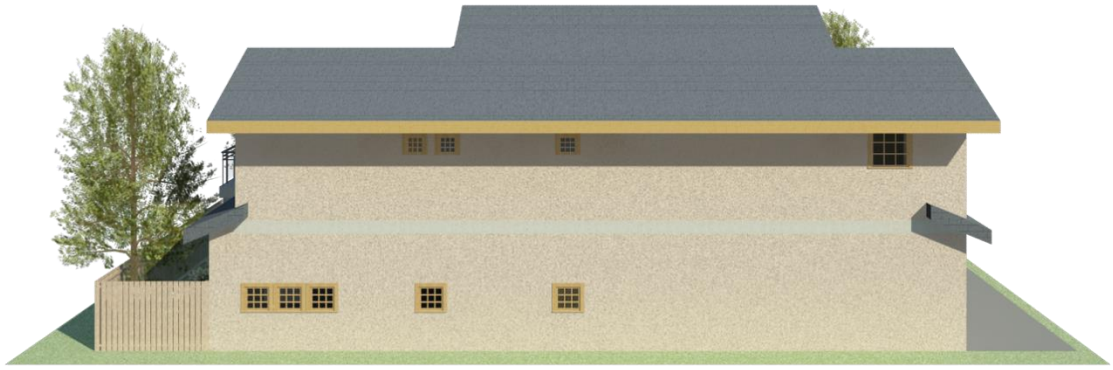


Figure 43: Rendered West Elevation for Linear Step Aquaponics

Figure 42 above shows the west elevation as providing the least amount of information and contains required windows for the two bathrooms on the second floor, the water closet on the first floor and the kitchen in order to provide more privacy for the yard on the opposing side of the wall. This elevation does not provide any views of the aquaponics system because it directly fronts the neighbor's yard with as little as only ten feet between homes along the east and west elevations. The aquaponics system between homes will help to alleviate having to create more privacy between homes, while also providing families with an aesthetically pleasing sustainable option.

Figure 44 below illustrates a final northeast perspective rendering of the overall home and Linear Step Aquaponics System. From this view the tree in the front yard is visible, as well as the front gate and stair access to the intermediate platform for grow bed 2. This image helps to show that although the backyards for these zero lot homes are small, this Linear Step Aquaponics option still provides families with ample space to play or to sit and relax on the upper lanai or ground level patio. This rendering was done for the Ewa Beach, HI location during noon, so that it clearly depicts the hour that the home and aquaponics system would receive the most direct natural sunlight.

Figure 45 on the following page shows a closer view of the Linear Step Aquaponics System alongside the main entry and living area. It provides a close up of the fishpond and the height difference between

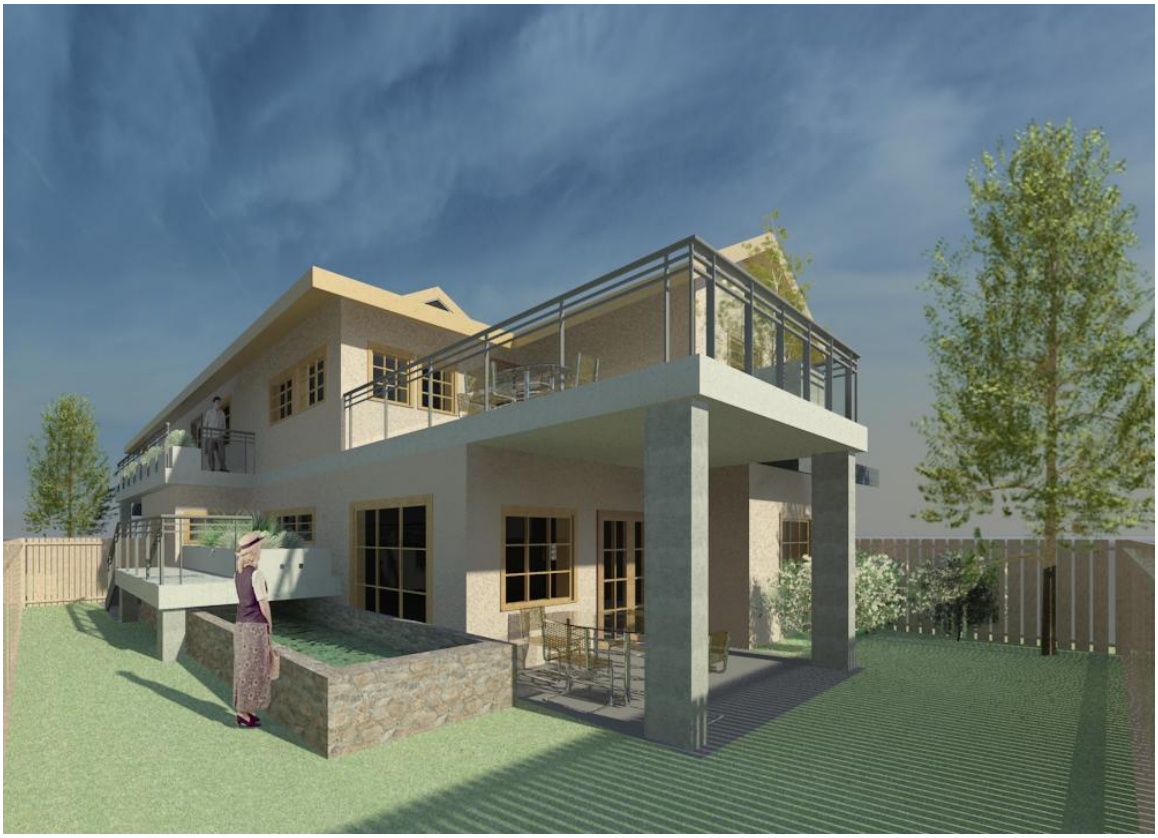


Figure 44: Northeast Perspective Render for Linear Step Aquaponics

Figure 45: Detailed Render of Linear Step Aquaponics System

grow bed one and grow bed two. The linear path of the grow beds and fishpond help to distribute the nutrients to all plants evenly while also helping to aerate the water naturally through the waterfall design. The two platforms combined with the grow bed helps to show the ease of access to gather fruits and vegetables while also providing a comfortable suitable area for aquaponics to be taught and maintained through the support facility maintenance guarantee, which is provided to each household that includes an aquaponics system design option with their home. Overall, the Linear Step Aquaponics System creates a design option for homeowners interested in planting a variety of plants that require low and high nutrient values.

Aquaponics Trellis Design:

The image in Figure 46 shows the site plan drawings for the Trellis Aquaponics Design. Again, as mentioned previously since the building ordinance requires each home to have a six foot fence surrounding the backyard, this design allows the aquaponics system to be accessed only within the private backyard which is not accessible to the public. Each plant and pond will be located

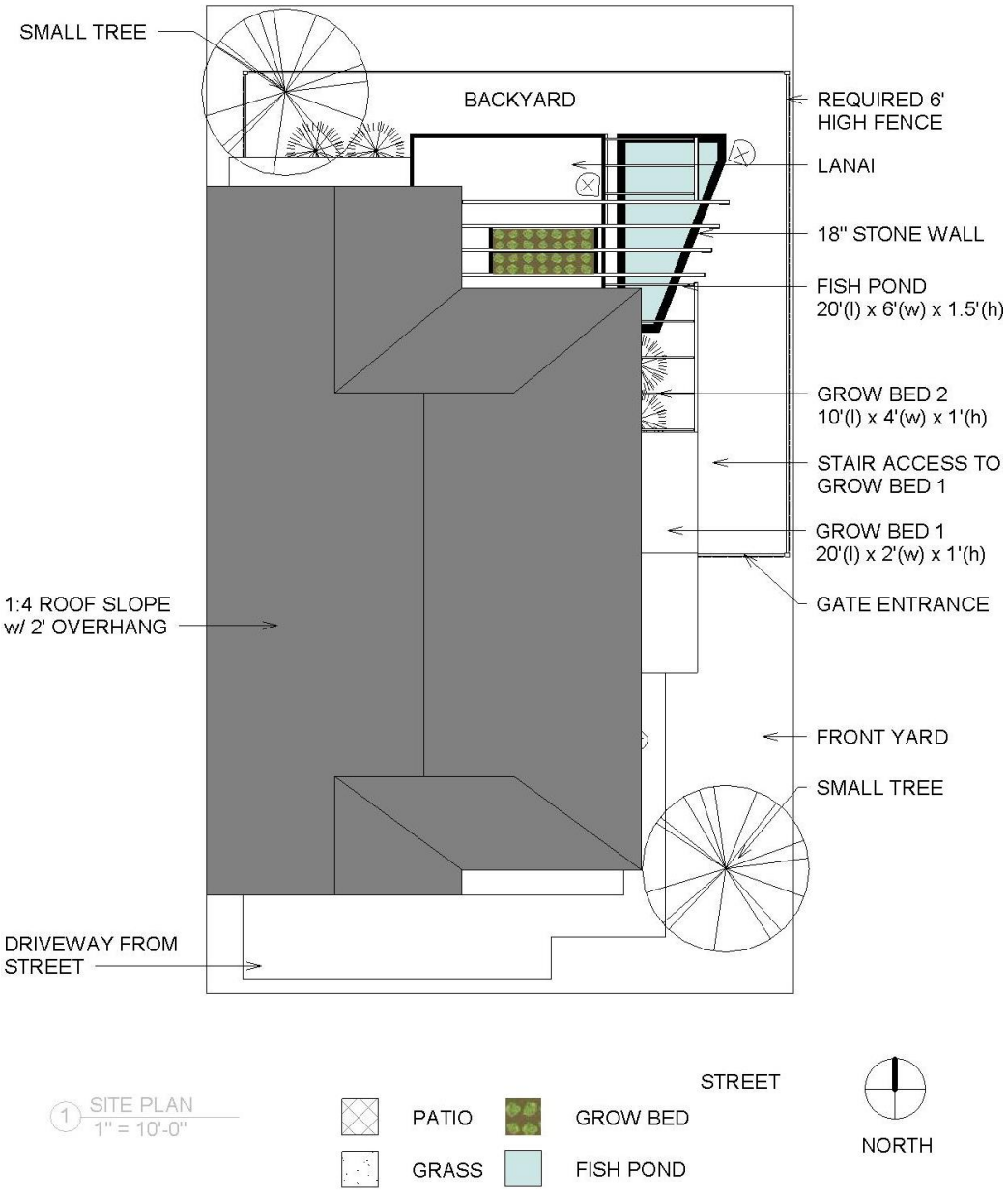


Figure 46: Site Plan of Aquaponics Trellis System

according to plot location and the occupant has the option of accessing the pond through either the living area that leads out towards the patio and backyard or through the gated fence near the main entry.

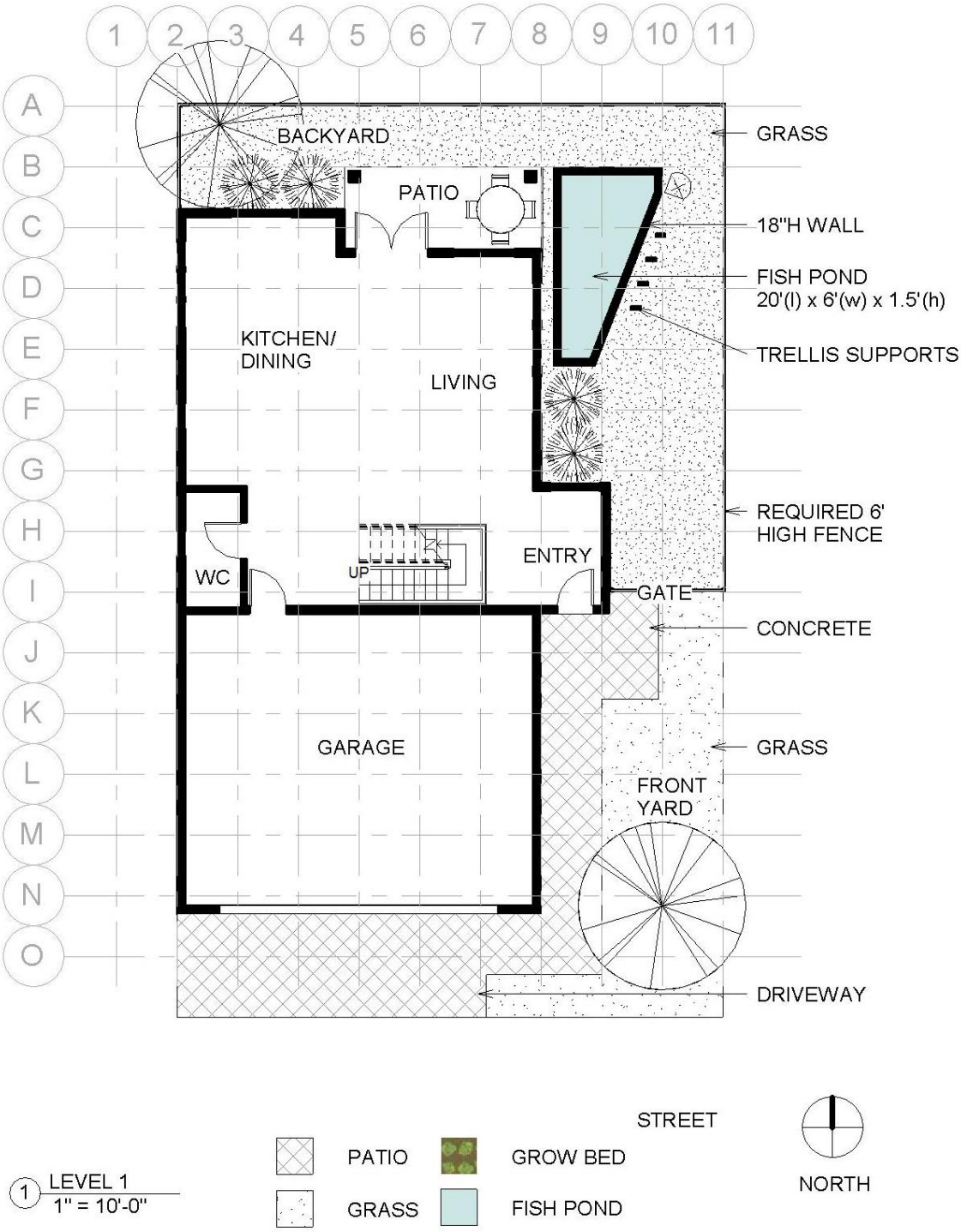


Figure 47: First Floor Plan of Aquaponics Trellis System

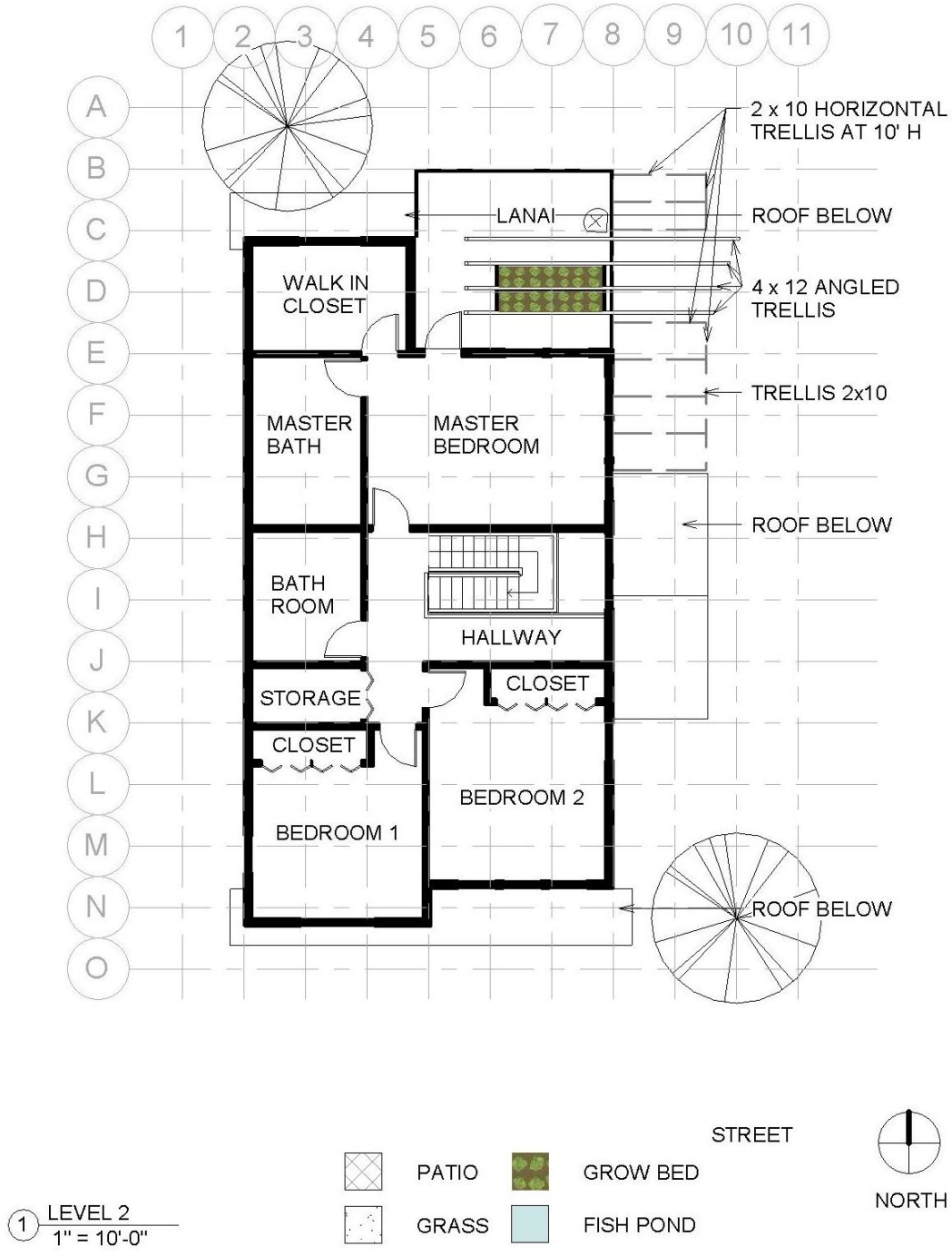


Figure 48: Second Floor Plan of Aquaponics Trellis System

The first floor plan is shown in Figure 47, which illustrates the base for the trellis support in the backyard along with the fish pond. The overall square footage has not been affected from its original layout, compared to the Linear Step Aquaponics System that had to accommodate a hallway on the second floor for access to the grow bed above the main entry. Since the waterfall is dropping from a greater height, it could help to provide a noise barrier on the first floor in the living area from nearby streets and neighbors. The second floor plan presented in Figure 48 shows the two grow beds on the lanai, as well as the trellis structure that connects from the roof eave to the trellis column support on the ground level. The trellis design offers shading and ample lighting for the fish, however it was mentioned by Dr. Bradley K. Fox in a meeting on November 21, 2013 that "the fish pond needs to have at least three quarters of shading overall or the pond will grow too much algae to maintain"[48] Therefore, an additional trellis was added for the final design to help accommodate more shading for the fish pond.

Figure 49 on the following page illustrates the South Elevation for the trellis design that shows similar materials to the Linear Step Design, such as the double pane low-e argon glazing windows, stucco finish exterior walls, attic ventilation, one foot asphalt shingle roofing with underlayment, eave protection and metal drip edge and a gated entry with latch as required by the building code, IBC, Chapter 31, section 3106. Figure 50 shows a rendered representation of the south elevation for the trellis design.

[48] Fox, Bradley K. in committee meeting 4 to Gina Takahashi on November 21, 2013

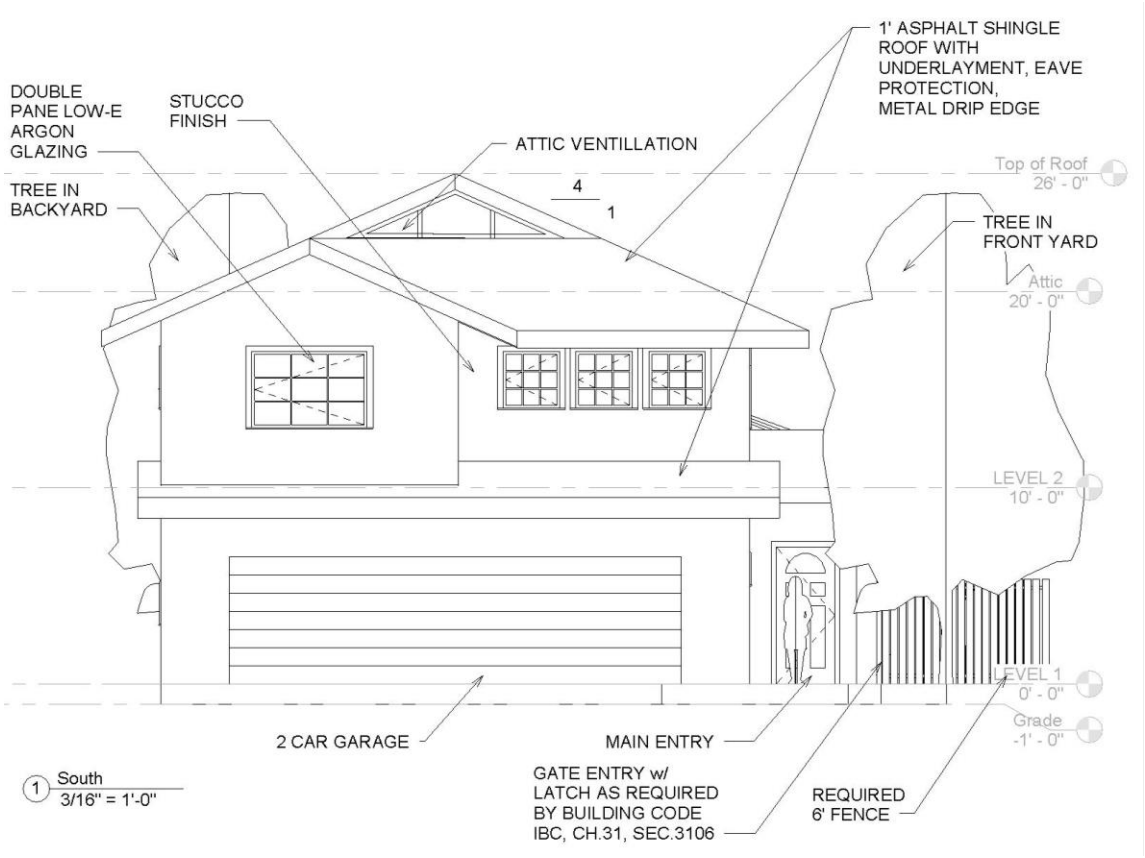


Figure 49: South Elevation for Trellis Aquaponics System

Figure 50: Rendered South Elevation of Trellis Aquaponics System

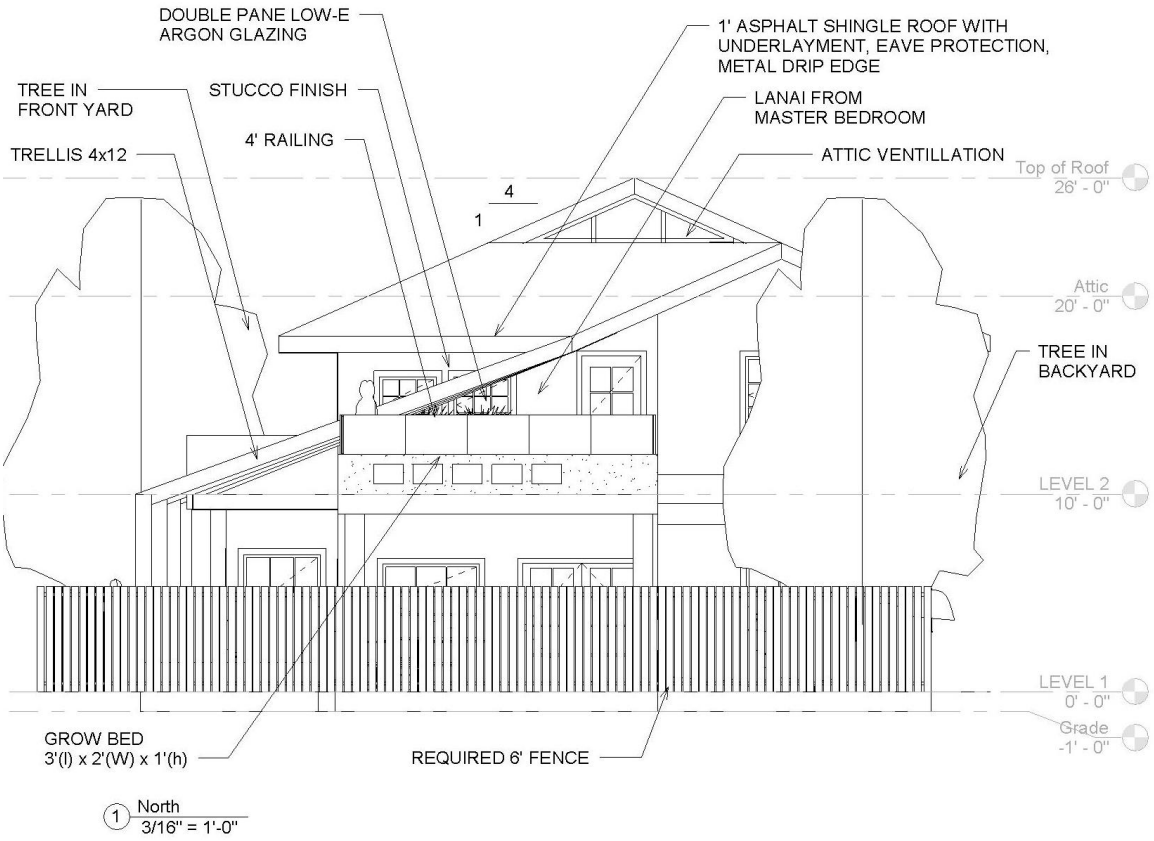


Figure 51: North Elevation of Trellis Aquaponics System

Figure 52: Rendered North Elevation of Trellis Aquaponics System

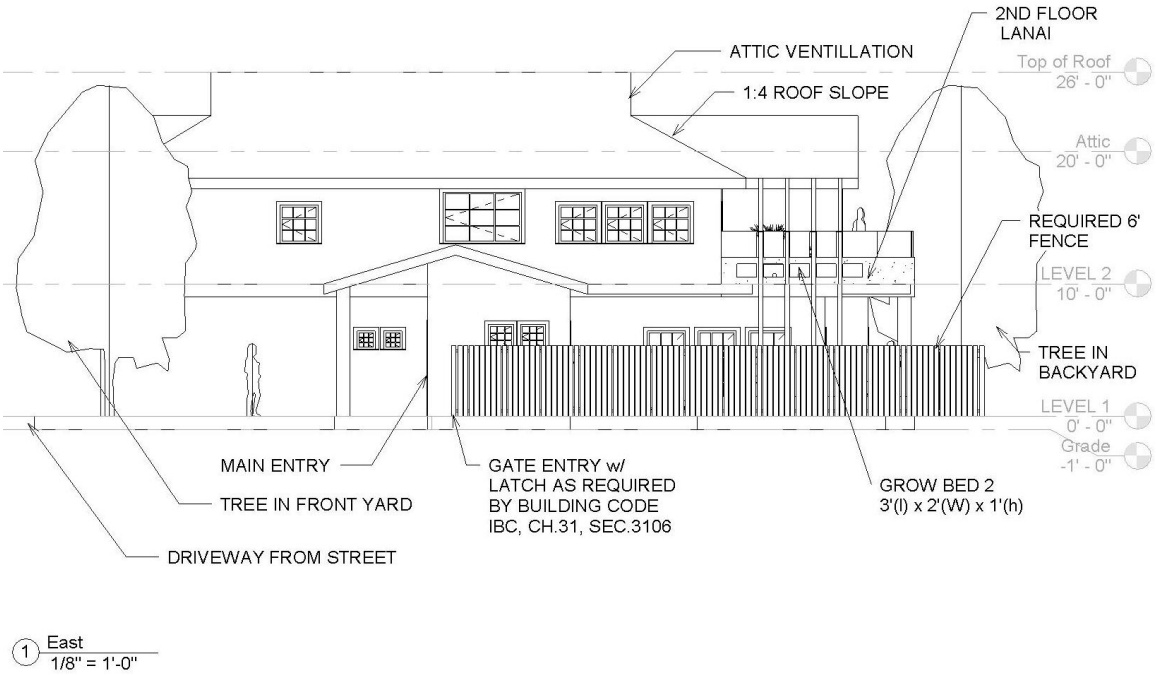


Figure 53: East Elevation of Trellis Aquaponics System

Figure 54: Rendered East Elevation of Trellis Aquaponics System

Figures 51 and 53 represent the north and east elevations of the trellis aquaponics design. These two images clearly depict the trellis design height, size and functionality. Figure 51 on the previous pages shows the 4x12 trellis spanning from the second level roofing structure to the trellis support columns on the ground floor next to the fishpond. The extra trellis that was added for the final design to accommodate for extra shading is a 2x10 trellis system that extends out from the second floor. Figure 52 and 54 illustrates a rendered elevation that visibly represents how the trellis system works with the original layout of the home.

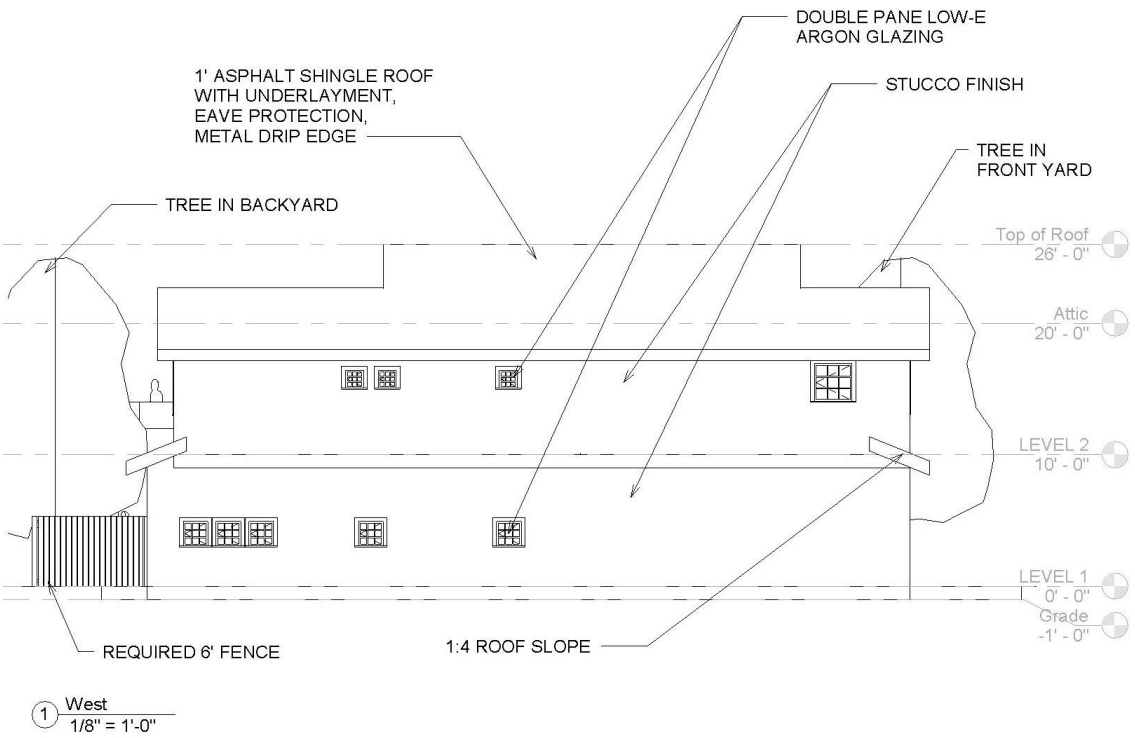


Figure 55: West Elevation of Trellis Aquaponics System

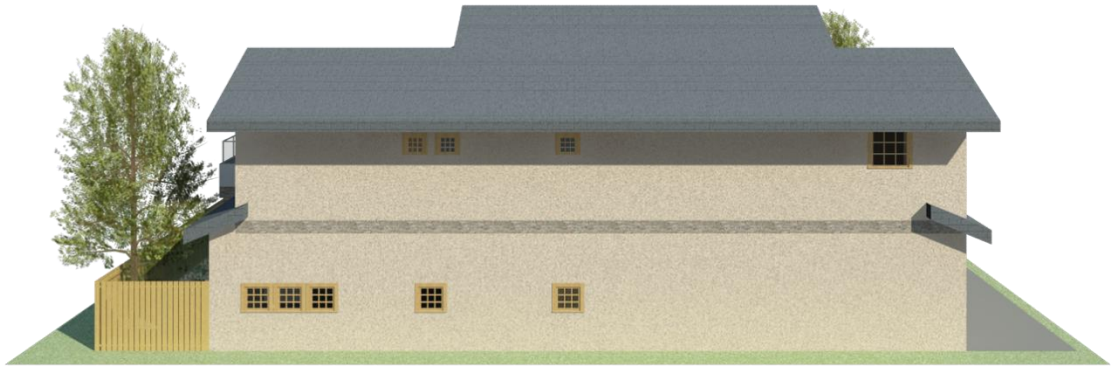


Figure 56: Rendered West Elevation of Trellis Aquaponics System

Again, Figure 55 and 56 above shows the west elevation and rendered west elevation of the trellis aquaponics system. This side of the home is similar to the linear step design due to the zero lot layout, the west elevation wall fronts the neighbor's yard, therefore resulting in very few required windows in the two bathroom on the second floor and windows on the first floor for the water closet and kitchen area. This, accompanied with the Trellis Aquaponics System will help provide more privacy for homeowners and their families.

Figure 57: Rendered view of Aquaponics grow beds from Lanai

Figure 58: Rendered view from Gate Entry

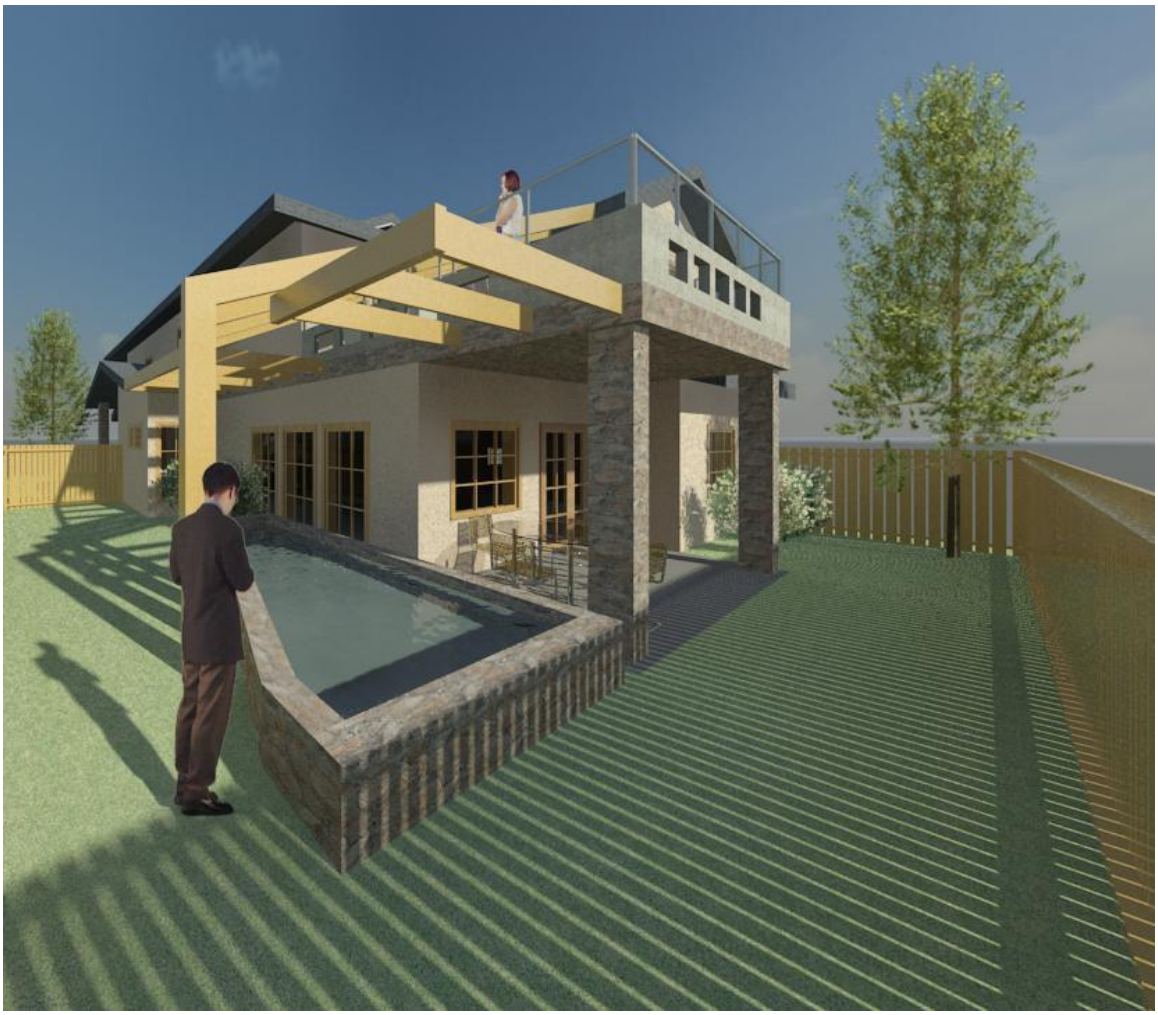


Figure 59: Rendered Northeast Perspective View

Figure 57 shows a rendered view of the aquaponics grow bed from the lanai, with support trellis above for vine plants such as green beans, eggplant and tomoatoes. Figure 58 illustrates a rendered view from the gate entrance. This view helps to show how the trellis on the lower level is connected to the original trellis layout from the second floor. It also reveals the size of the yard between lots and how it could help to provide privacy from both the patio and lanai areas. Figure 59 shows the overall rendering of the northeast perspective view from the backyard. The Trellis Aquaponics System creates a design option for homeowners interested in planting a variety of plants that need the extra support or shading from the trellis system.

Case Study

The Avenue: Sasaki Associates, Inc.

The Avenue, formerly referred to as Square 54 and 2200 Pennsylvania Avenue, is a dynamic mixed-use development bordered by Washington Circle, 23rd Street and Pennsylvania Avenue and located just six blocks northwest of the White House.[49] Currently there are no project that integrate architecture and aquaponics into one cohesive design from start to finish and through extensive research this has been one of the most prominent projects researched that could hold key answers to integrating architecture and aquaponics successfully. The Avenue is located in downtown Washington, DC and was recently completed in August 2011 with LEED CS 2.2 Gold by Sasaki Associates, Inc. and team Pelli Clarke Pelli Architects. The projects overall design brought together disciplines of Architects, Landscape Architects, and Planning and Urban Designers. In 2012 The Avenue was honored with the 2012 ULI (Urban Land Institute) Global Award of Excellence, as well as the National Best of the Best Projects: Best Retail/Mixed Use Developments, Engineering News Records. The mixed-use complex in Washington D.C. includes office, residential, and retail elements and abundant green public spaces, streetscapes, terraces, and courtyards with innovative stormwater management strategies.[50] Figure x shows the conceptual 3D model of the development and design of The Avenue. This central area of the design integrates parking, pedestrian pathways, and shaded seating areas while offering beautiful views of tree promenades, water features and green spaces that allow users to relax within the busy city of Washington D.C.'s busy downtown areas. The central courtyard above the parking structure is anchored by a water feature that expresses the intersection of the historic Washington city grid and the axis of Pennsylvania Avenue, as shown on the site plan in figure x below, while also functioning as part of a larger stormwater management system that collects all rainwater that falls within the property.[51] The footprint of the four buildings on site are said to be designed with the user in mind, allowing for an open space within the buildings

[49] *The Avenue.* August 2011. http://www.sasaki.com/project/8/The%20Avenue/ (accessed January 31, 2013).

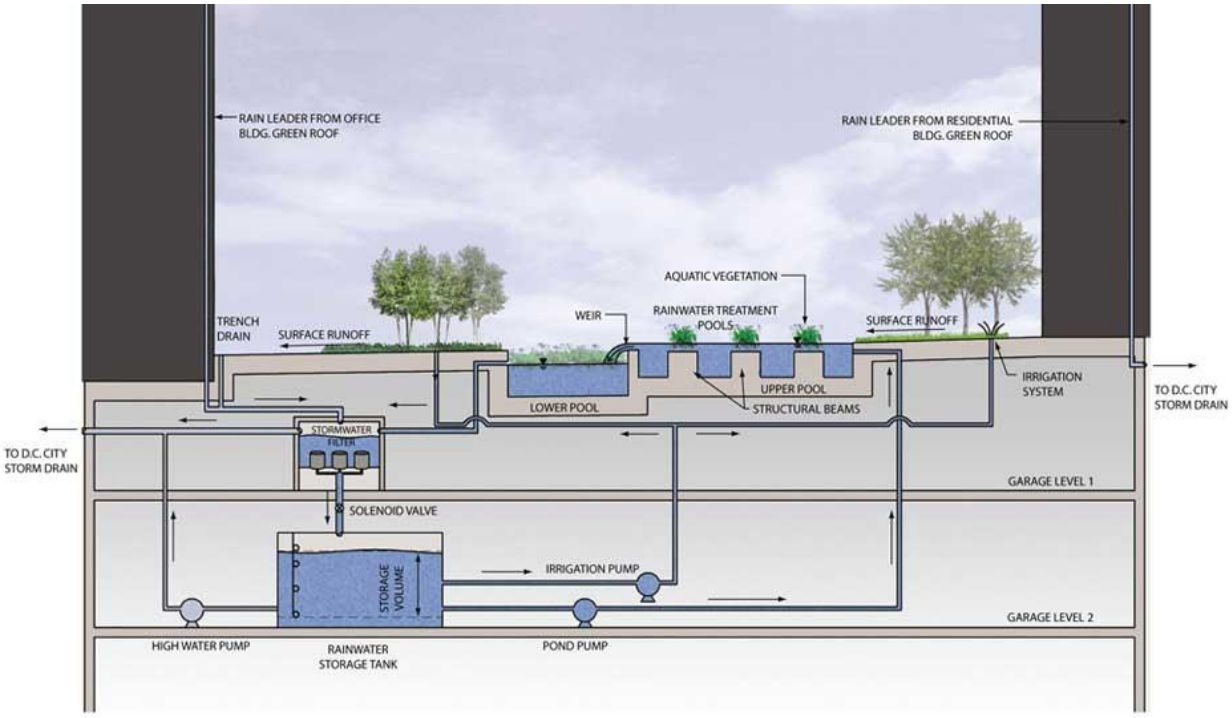
[50] *Stream.* October 19, 2012. http://www.sasaki.com/stream/view/235/ (accessed February 2, 2013).

[51] Ibid.

while permitting use to the surrounding public. The streetscape on the perimeter of the site includes wide sidewalk promenades bordered by rows of shade trees, large planting beds filled with mixed perennials, low shrubs and flowering trees, and a series of architectural planters filled with colorful seasonal plantings. (http://www.sasaki.com/project/8/The%20Avenue/) As shown in the site plan, there was no room for parking so the amount of parking required was met by locating a five-story parking garage directly beneath the site perimeter.

Figure x below shows a section diagram of the stormwater management system onsite through the central area between the residential and business commercial towers. This section helps to show how the rain water is collected on the site, filtered, stored, and pumped back into the site serving as an irrigation system. If the tank fills or the water gets too high the excess water is released back to the Washington D.C. City storm drain system. The central water feature in the courtyard functions systematically and aesthetically as part of the whole stormwater management system that collects rainwater which conveniently drains through a stormwater filter located directly below the central courtyard in the parking garage. The water that is filtered and stored in a 7,500 gallon cistern is continuously recirculated and treated by the water feature that includes aquatic plantings that offer supplemental filtration. In addition to the

aquatic plants the surrounding buildings have 8,000 square feet of green roofs that help to filter the excess rainwater through green roof layers, minimize stormwater runoff and control microclimates that help to reduce the local heat island effect. (http://www.sasaki.com/project/8/urban-courtyard-saves-water-and-dollars/) This on-site



sustainable water system significantly reduces the development's dependence on the city's inadequate combined sewer system, which periodically results in flooding of the National Mall and low-lying areas and contributes to pollution of the region's rivers and streams. (http://www.sasaki.com/project/8/urban-courtyard-saves-water-and-dollars/) It has also been noted recently that the courtyard at The Avenue helps to eliminate the use of potable water, saving 76,000 gallons of water and approximately $730 per year. The landscape also reuses runoff, features native and drought-tolerant plants, and incorporates high efficiency irrigation systems, reducing water needed for irrigation by a total of 62%. (http://www.sasaki.com/results/)

Pertinent Issues and Challenges

This doctoral project research purpose is intended to show how aquaponics can be used as a self-sustained method in the future to improve current single family housing development. Further experimental research is required when funding becomes available. This project focuses on aquaponics as a new sustainable solution to improve current tract housing developments. Some of the pertinent issues and challenges are as follows:

- Short and long term economic outcome and benefits have not been verified at this time until funding becomes available through possible government, non-profit organizations or other private research funding.
- Unlike photovoltaic, water catchment, grey water reuse, energy efficient appliances and other methodologies; aquaponics is yet to be approved by governing agencies as a viable sustainable solution. Support from legislature and current policies could help with the recognition of aquaponics as a feasible method.
- Aquaponics is yet to be viewed as a viable solution by the AEC community due to the lack in understanding of aquaponics as a new sustainable solution. Educational seminars are needed so that the AEC industry could be the leaders of applying aquaponics in future designs so that builders will realize that aquaponics could potentially be a viable possible method that could be included as part of the standard design.
- Current organizations related to sustainable developments could use more help and support towards the movement of self-sustained innovative methods. This could be done through community education, public, private and non-profit educational and promotional events.
- With the recognition of aquaponics as a self-sustained and sustainable technology, qualified organizations, such as LEED could include aquaponics as a path to a credential for receiving recognition for being self-sufficient.
- Not many outside of the AEC industry have heard about aquaponics. Perhaps, early education and exposure in aquaponics technology could be implemented through academia, architectural agencies, and other social media therefore those who are not

familiar with the technology could understand the importance and are more aware of this type of innovation.

- Currently there are no subsidies program that include aquaponics technologies. Perhaps future government subsidies or private grants could help push this technology forward.
- Although there will be views that including aquaponics as a standard housing design might be costly causing owners to be hesitant in including this technology. The value of what could be gained from aquaponics is much greater; participants will gain self-reliance, self-suficiency. At a community level, it could lower food prices and create higher quality products, while raising the standard of food quality. At a state level, the import and export choices could possibly be changed for the better, so that the nation could rely less on imported goods and increase income through exporting higher quality produce and fish.
- Due to the lack of knowledge and understanding in the aquaponics systems, many could deter from including aquaponics due to the maintenance. However, this doctoral project suggests an onsite maintenance facility that could support and teach occupants for future growth, which could also create jobs and provide an opportunity for Hawaii to be the leaders for including aquaponics systems. Experts of aquaponics could also grow by spreading this knowledge beyond Hawaii, in neighboring United States Mainland and other developing countries.
- Currently aquaponics is lacking a governing agency, by developing an agency, it could help many of the issues and challenges of including aquaponics, perhaps Hawaii could take the leadership role.

Although this project does not address everything it is anticipated that the idea will create a trend for future designers, home builders and users.

Conclusions

In conclusion, places like Hawai'i need to be more self-sustained. With the numerous innovative ways to integrate self-sustained practices such as aquaponics in the field of architecture, it is through confidence that this project helped to increase the awareness of the importance of self-sustenance through integrated design option of aquaponics systems in single family housing development. Creating an aquaponics system that creates jobs and improves typical suburban single family housing development lifestyles with the help of support maintenance facilities, will allow for future growth in Hawaii towards a more self-sustained future.

Ways of practicing self-sustainability for medium income families

Through this doctoral project, aquaponics has demonstrated to be a successful self-sustained method for single family housing development. Through various research of current tract housing developments and multiple design options, aquaponics could easily be included as part of the tract housing current designs with slight modifications to the current structure and backyard layouts. A pond could be included in all backyards which would create ample lighting for fish and consistent temperatures throughout the day. If a mini waterfall design option is chosen, the green roof would provide a suitable amount of produce and fish for a family of four to five with room for growth, while also providing natural aeration of water for fish and plants and an even distribution of nutrients to plants. Plants and water could help create privacy between homes and possibly create therapeutic environments both inside and outside.

Architectural, Engineering and CAD technologies as leaders of self-sufficiency

Through research it has been found that Hawaii relies on 80% of imported food, therefore it is important for AEC to be the new leaders in pushing more sustainable methods throughout the overall designs. Early education and exposure could help to implement aquaponics systems as a viable method for self-reliance to enabling Hawaii to be more aware of current issues pertaining to import dependence.

Importance of Aquaponics

Aquaponics reduces the burden placed on our oceans by promoting reliant food sources like fish, it does not depend on local soil quality or acres of fertile soil like with traditional farming

and may even be set up indoors with proper lighting. Aquaponics also requires 90 percent less water than conventional farming methods where most of the water is absorbed and dried up into the land, it produces up to ten times more crops in less amount of space and time than is required for traditional farming methods and uses up to 75 percent less energy that almost any other farming method. Most systems can produce year-round organic vegetables, fruits, and fish because there is no need for pesticides, fertilizers, herbicides for plants or antibiotics or hormones for the fish. If aquaponics were fully or partially integrated with architectural design and there were ways to use aquaponics in certain areas of landscaping or even serve as green roofs and walls that could aid in multiple services; edible landscaping, insulated properties, reducing heat islanding in urban areas, and so on, it would be beneficial because combined technologies of architecture and aquaponics could reduce the carbon footprint of buildings that are responsible for 39 percent of carbon dioxide (CO_2) emissions in the United States per year as seen in the chart below provided by the USGBC (U.S. Green Building Council)[52], it could minimize energy use by incorporating renewable energy technologies, offer residence the freshest food with minimal transportation, as well as provide a wide range of healthy and high value foods all year round.

Issues of using aquaponics for self-sustenance

The issues for using aquaponics as a self-sustained method have been listed under the pertinent issues and challenges and it is in hopes that after addressing these issues, the idea will be taken into consideration as part of a design method that could improve current tract housing development in Hawai'i and other locations that are currently struggling with similar reliance of imported fish and produce.

Self-Assessment

This project has given me the opportunity to explore beyond the current boundaries. It has taught me the values in the importance of self-reliance and finding various solutions to sustainable methods aside from including photovoltaic panels, energy efficient appliances, grey water reuse, and so on.

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[52] [8] *USGBC Buildings and Climate Change.* December 2, 2008. http://www.documents.dgs.ca.gov/dgs/pio/facts/LA%20workshop/climate.pdf (accessed October 7, 2012).

Overall, this doctoral project was successful in addressing the project statement, goals and objectives, while answering the research questions by providing the solutions to viable sources in addressing the current issues that Hawai'i faces, including relying on imported goods.

Since Hawai'i is not the only place that faces this problem, there are also other neighboring places such as the United States Mainland, isolated islands and developing countries that could possibly further expand and utilize the aquaponics technologies tailored to their own architectural trends.

However, it is in hopes that this research project will continue to encourage future architects, students, new homeowners/interested buyers and AEC to provide better sustainable living environments through aquaponics while preserving the quality of life and the future of Hawai'i through a more self-reliant culture.

Appendix A: Ewa by Gentry Community Association Design Committee Rules and Regulations

Ewa by Gentry
Community Association

Design Committee Rules & Regulations

Revised 04/24/08
This copy supersedes 10/28/03

91-1795 Keaunui Drive • Ewa Beach, Hawaii 96706 • Phone: (808) 685-0111

INTRODUCTION

On behalf of the Board of Directors, welcome to Ewa by Gentry Community Association. By now you have selected, purchased or moved into your new home or unit. Moving can be a stressful pursuit with many long-range benefits. We truly hope that when it is all said and done that you will feel confident and secure in your new home and surroundings.

You have chosen to live in a planned community, which for some, may be challenging. Planned communities abound nationwide and continue to grow in numbers. Ewa by Gentry, like all planned communities, has 'covenants' and rules for homeowners to follow. The moment you signed your deed, you agreed to uphold the Declaration of Covenants, Conditions and Restrictions referred to as 'the covenants', and these rules. We know how difficult the closing procedure can be and we realize that you may not have the time to read the covenants or the rules thoroughly. That is why we published this booklet, to make it easier to find the information you need while you develop your plans to improve your new home. You can also review these documents on our website at ***http://www.ebgca.net***.

I. EWA BY GENTRY DESIGN PHILOSOPHY

The basic design philosophy of Ewa by Gentry calls for underlying order and contemporary lines, which add to, rather than detract from the appeal of the community at large. The Committee discourages excessive ornamentation designs for walls, fences, gates, trim, extensions, covered lanais and decorative ornaments. Simplicity often lends the most to the existing architecture found in the community. By using clean lines, geometric designs and vertical and horizontal expressions, the cluttered appearance of scrollwork and 'gingerbread' can be easily avoided.

Finally, a master planned community emphasizes design criteria that are compatible, complementary and cohesive, so that all elements blend with one another. Elements that detract from this ambiance are clearly not acceptable.

II. MEMBERSHIP

Association membership is automatic when a homeowner signs his or her deed and the only way to avoid the covenants is to sell the home. The biggest difference in living within a planned community is that you need approval to make changes to the exterior of your home or your lot. When you buy a home in a planned community, the staff will help you when applying for modifications to your home. The staff will also work with you to maintain compliance. Covenants enforcement is our greatest tool in maintaining property values and specific standards of a well-groomed community.

The covenants and rules are designed to protect, preserve and enhance property and its value at resale. Real estate prices are established by 'comparables' or, in other words, neighboring homes. The covenants and rules will not allow any one homeowner or tenant to have a negative effect upon any other homeowner's property value. Therefore, all homeowners, their families, visitors and tenants must abide by the standards set by the covenants and rules.

The Board of Directors is also bound by the covenants and must put the mechanisms in place to enforce the conditions and restrictions required by the covenants. The Board members strive to

fulfill their duty in the most fair and amiable way possible. The Board must also oversee the selection of the Design Committee.

III. DESIGN COMMITTEE DUTIES

The Design Committee's role is to protect the visual character of Ewa by Gentry and, by inference, the most favorable economic interests of all property owners. They must be primarily concerned with the designs of the exterior of the residence including landscaping, and with any materials used, including window treatments, which are visible from the street and neighboring properties, including the golf course.

IV. AUTHORITY

The Design Committee, like the Board of Directors, is a decision making body and has the authority to amplify the requirements of the covenants, add to and alter the rules, review applications for approval and to approve or disapprove plans based on objective criteria. They must balance the needs of the community with the needs of the individual homeowners. The Committee always seeks fair, objective and equitable decisions. However, they will not be able to grant every request. Homeowners can best prepare their requests with several options, should one or more of the options be denied by the Committee. This saves time for the Committee and the homeowner in that the Committee may guide the homeowner toward the best of the options submitted.

The Committee must avoid **subjective** decisions in that everyone's idea of 'pretty' or 'attractive' is relative to each person's tastes, background, origin, culture and preference. Thus, in order to enable the Committee to perform its duties objectively, the Committee has established requirements for walls, fences, window tinting and shades, lighting, concrete slabs, walkways and major improvements. Within this rulebook, you will find guidance on most topics that apply to restricted applications.

In performing its duties the Design Committee may, but shall not be required, to conduct a hearing or to consult personally with the persons or parties who submit proposals or plans for Design Committee approval (Article IV, Section 4.01, Item d).

V. RULE DEVELOPMENT

The Design Committee has the authority to update the rulebook, making changes approved by the majority of the Committee and certified by the Board Secretary. Each revised edition will be printed on colored paper and dated to verify the version of the rules. In all cases, unless there is a dated permit, the most recent version of the rules shall apply.

A copy of each new rule and each amendment or repeal of an existing rule shall be filed in and shall be available for inspection at the office of the Association, and duplicate copies shall be delivered to each Owner upon his acquisition of a lot or unit in the Community Area. A copy of each new rule and each amendment or repeal of an existing rule shall likewise be given to each Owner. Design Committee Rules shall have the same force and effects as if they were set forth and were a part of the DCC&R's. **The failure to deliver to any Owner a copy of a rule or an amendment or repeal shall not render such rule, amendment or repeal invalid.**

For any improvements installed or constructed without a permit, the prevailing version of the rules shall apply. Therefore, anything constructed when the rules allowed but later disallowed shall not be 'grand fathered', but shall be reviewed with the prevailing version of the rules, not those from the date of the original installation.

VI. WAIVER OF APPROVAL

The approval of the Design Committee of any plans and specifications for any work done or proposed or submitted in connection with any matter which requires the approval of the Design Committee, shall not constitute a waiver by the Design Committee of its right to withhold its approval of any similar plans and specifications or any other matter subsequently submitted for approval, whether or not by the same person or party.

VII. OTHER CODES, LAWS, RULES & ORDINANCES

Approval of plans does not modify or eliminate the owner's obligation to comply with all existing laws, ordinances, rules and regulations, and as may be amended, or hereafter made by any governmental authorities or with such terms and conditions required under the Master Declaration of Ewa by Gentry, or any deed, lease, or mortgage. In case of conflict, the more stringent requirement shall apply.

VIII. DEFINITIONS: Please refer to these definitions to clarify specific questions.

Architect – Shall mean a person registered to practice architecture in the State of Hawaii under the authority of Chapter 464 of the Hawaii Revised Statues (1985), as amended, or registered pursuant to the provisions of the state laws of the state of his domicile.

Association – Shall mean the Ewa by Gentry Community Association, a non-profit corporation described in Article V and its successors.

Backyard - Shall mean any portion of the yard beyond the rear face of the house.

Board – Shall mean the Board of Directors of the Association.

Corner Lot - Shall mean any lot with two property lines adjacent to roadways.

Covenants Committee- shall mean the committee, if any, appointed by the Board of Directors to oversee and establish policies and procedures concerning the enforcement of the Master Association governing documents. The Covenants Committee may not override any decisions or appeals made by the Board or Design Committee.

Declaration of Covenants, Conditions & Restrictions (DCC&R's) - Shall mean the recorded document dated July 21, 1988 and any recorded subsequent amendments.

Design Committee – Shall mean the Committee created pursuant to Article IV, "Improvement of Property."

Design Committee Rules - Shall mean these rules adopted by the Design Committee pursuant to the Declaration (Article IV, Section 4.01 item f) including any revisions or alterations which are approved by majority of the Design Committee and the Board.

Drainage Pattern - As illustrated on the homeowner's plot plan, the arrows that indicate the path of the swale or the direction of the natural water/rain run-off.

Driveway: Paved area leading to garage. The driveway does not include the pedestrian sidewalk preceding the paved driveway.

Engineer - Shall mean a person registered to perform engineering services in the State of Hawaii under the authority of Chapter 464 of the Hawaii Revised Statues, as amended, or registered pursuant to the provisions of the state laws of the state of his domicile.

Ewa by Gentry Community Area – Shall mean all of the real property referred to in Section 2.01, together with such other real property from time to time added thereto under the authority of Section 2.02, "Addition of Property Subject to Restrictions."

Ewa by Gentry Community Living Rules – Shall mean the rules which may be adopted, amended or repealed from time to time pursuant to Section 5.06, "Ewa by Gentry Community Association Rules."

Excavation – Shall mean any disturbance of the surface of the land (except temporarily for planting) which results in removal of earth or rock to a depth of more than eighteen (18) inches.

File – Shall mean, with respect to any document or map, to record such document or map in the Bureau of Conveyances of the State of Hawaii and/or to file the same in the Office of the assistant Registrar of the Land Court of State of Hawaii.

Fill – Shall mean any addition of rock or earth materials to the surface of the land (except temporarily for planting) which increases the previous elevation of such surface by more than eighteen (18) inches.

Front Face of House - Shall mean the side of the house facing the street.

Front Yard - Shall mean the area between the front face of the house and the front property line.

Gravel - as defined for limited landscape purposes, shall be defined as all inert material including but not limited to: stones, pebbles, cinder, river rock, crushed rock, and coral.

Improvements - Shall include buildings & additions, outbuildings, roads, driveways, parking areas, fences, retaining walls, covered lanais, trellises, stairs, decks, walkways and patio slabs, hedges, windbreaks, planted trash surrounds, windows, doors, tinting, permanent basketball backboards and any other structures of any type or kind.

Inert material – Shall mean any material that is non-living such as concrete, gravel, pavers, etc.

Landscape - Shall mean to adorn, improve, or arrange the grounds attractively by clearing and/or contouring the land and planting grass, ground cover, flowers, shrubs and/or trees.

Lot – Shall mean a parcel of land in the Community Area created by legal subdivision and designated on a duly filed subdivision map which contains an area of not more than 10,000 square feet and is intended to be improved by construction of a dwelling unit thereon.

Owner or Homeowner - Shall mean the person or persons, corporation or corporations, or other legal entities whose name(s) appear on the deed of any given lot as the legal owner(s) thereof.

Quorum – Percentage of committee members needed present to legally hold a meeting. If a meeting is held without a quorum, all decisions made during said meeting will be null and void.

Record – Shall mean, with respect to any document, to record such document in the Bureau of Conveyances of the State of Hawaii and/or to file such document in the office of the Assistant Registrar of the Land Court of the State of Hawaii or both.

Residential Area – Shall mean any real property classified as such pursuant to Article III, together with all improvements constructed thereon, which is developed to provide dwelling units for sale to Owner.

Retaining Wall - Shall mean any structure constructed for the purpose of containing or supporting any embankment, fill, or other earthen form.

Road or Street – Shall mean any public road or street or any private paved vehicular way constructed within or upon any portion of the common areas, including any apron or other paved access from such public road or street or private vehicular way to sites within the Community Area.

Side Yard - Shall mean any portion of any yard, which lies between the front face and the rear face of the house.

Single-Family - Shall mean one or more persons living and cooking on the premises together as a single, non-profit housekeeping unit; provided, however, that the number of persons living on the premises shall not exceed the standards and requirements set forth in the Housing Code of the City and County of Honolulu.

Storage - Shall mean any item or items on any lot or unit lanai or yard not in immediate use, not designed for outdoor use, stacked for storage purposes, placed in cardboard boxes, plastic rubbish bags or other containers, and shall include gardening or cleaning equipment, building materials and equipment, automotive and boating tools, parts and accessories, coolers, barbeque grills, shoes, toys, rubbish or refuse of any kind which is visible to any street or adjacent property and prohibited by the DCC&R's.

Storage of Lumber - Shall mean the piling and/or stacking of any wood, timber or lumber which is cut, untreated and/or unsealed in any lot near any location wherein termites may reside. Any stored lumber with the above description must be stored solely within the garage of the house or off the property.

Stored "Out of Sight" – Shall mean that the items must not be visible from street or neighboring properties. *See definitions for "Visible from Street" and "Visible from neighboring property."*

Swale - Refers to the valley-like dip in your yard that allows water/rain to run off. The drainage pattern refers to the direction in which the water/rain flows to exit your lot. Swales are typically identified on your plot plan by directional arrows.

Unit – Shall mean a complete and independent dwelling unit, whether standing alone or attached to another dwelling unit or part of a building containing multiple dwelling units, but only from and after such time as construction of the unit has been substantially completed and the unit is lawfully fit for occupancy; provided, however, that a dwelling unit created as part of a condominium shall be deemed a "Unit" for the purposes of this Declaration only from and after the time that the Declaration of Condominium Property Regime has been recorded and the dwelling unit has been completed and is lawfully fit for occupancy.

Visible from Neighboring Property - Shall mean, with respect to any given object or activity, that such object or activity is or would be in line of sight originating from any point six (6) feet above the lowest adjoining property, excluding contiguous property owned by the owner of the property involved, but including common areas and streets, highways, adjoining lots, the Coral Creek Golf Course or the shopping center. Example: An alteration to the lanai of an owner's property is visible from neighboring property if it is visible to a person of average height standing at ground level on an adjoining Lot, the street, the golf course or shopping center.

Visible from Street- shall mean, with respect to any given object or activity, that such object or activity is or would be visible from any point of a street or highway fronting the Lot or adjacent to the Lot.

Xeriscape - Shall refer to planned landscaping using water conservation techniques and designs, which provide beauty and function. It is a water conservation landscape design, which includes but is not limited to plants, turf grass, and hardscape (rocks or gravel).

IX. DESIGN COMMITTEE APPLICATION PROCEDURES

Application Requirements & Timetable
Eight Steps to Making the Application & Review Process Easy
The following will briefly identify what you will need & the time schedule to follow:

Step 1 You decide to make changes to your property.

Step 2 You review the Declaration of Covenants, Conditions & Restrictions.

Step 3 You obtain and review these rules which are also available online at www.ebgca.net or from the Ewa by Gentry 2nd floor office.

Step 4 You obtain specific information in preparation for submittal.

Except for **ONE (1)** copy of the application, submit **TWO (2)** of the following:

Two plot plans (copy which you obtained at closing) with your improvements clearly shown and highlighted (criss-cross marks or color coding are very helpful). Plot plans usually say 1" = 10'. This is your scale for measuring. One inch on your ruler is ten feet on paper. Call out all dimensions, they are critical, especially location of the improvement including the number of feet from any property line.

Two samples related to your proposal, for example two samples of window tinting, photographs, brochures, renderings, drawings for garage doors, screen doors, skylights, etc.

Two full copies of blueprints or architectural drawings prepared by a professional, where applicable. If you use blueprints, be sure the architect or draftsperson has clearly copied your plot plan onto the prints. If so, you do not have to submit a separate copy of your plot plan.

Two signed copies of the neighbor's awareness form for any work that affects the easement on your lot (if applicable).

Two copies of any other appropriate material to clarify your request.

Note: Only **one copy or sample** will be returned to you. The second copy is filed with your request as a record of what was requested. If you need your samples to be returned, be sure to have alternate samples ready.

One check or money order, where applicable, for the application fee.
THE EWA BY GENTRY OFFICE DOES NOT ACCEPT CASH UNDER ANY CIRCUMSTANCES.

Step 5 You turn in the completed application with supporting documents and samples to the Ewa by Gentry office well in advance of the next Design Committee meeting. Reminder: **Your request must comply with the DCC&R's and the Design Committee Rules. Those that do not will be automatically denied.**

Contractors and suppliers may not submit plans, materials, or products for review to the Design Committee. Should a contractor or supplier submit an application on behalf of a property owner, the property owner has the sole obligation to submit complete and accurate plans for work to be performed. Only with written permission from the property owner may an EbGCA permit be released to a contractor or supplier.

Helpful Hint: The Design Committee currently meets approximately twice every month. You should turn in your application and attachments no later than noon on the business day prior to the meeting at which you want your application reviewed. Call the EbGCA office for a current meeting schedule. However, please be aware that meeting dates are subject to quorum and subject to change without prior notice.

Step 6 Upon receipt of your fully executed, signed, paid for application and all necessary drawings and documents, the Design Committee shall review your application within no more than 30 days for final plans and 45 days for preliminary plans. The Association staff will review your application and the supporting documents with you to confirm that the necessary documents and information has been provided. This is intended to assist you and should not be confused as a guarantee of Design Committee approval. The staff is not on the Committee and cannot approve on their behalf. Pre-review of your application by the staff takes

unapproved changes will be solely at the owner's expense. Furthermore, the owner is subject to any resulting fines for the duration until the violation is altered or removed.

BUILDING WITHOUT A PERMIT

Homeowners are encouraged to develop their properties to their tastes within the limits set by the covenants and rules. Every homeowner is required to apply in advance for those improvements, which require prior approval. Any homeowner who proceeds with construction without approval may be ordered to cease construction and will be fully responsible for any and all costs to correct non-approved modifications. In short, each homeowner building without a permit does so at his/her own risk.

AFTER THE FACT APPLICATIONS & PERMITS

Any homeowner, including their contractors, tenants, family members, friends and/or visitors who elects to build upon or in any way alter the lot without prior approval and permit is in violation and is fully responsible for all costs related to removal or alteration of the unapproved modification, or any other measures necessary to bring the lot into compliance.

If you have a Design Committee violation on your lot, you must come forward and apply for the item. **If you voluntarily bring the violation to the Covenants Department, there will be no After-the-fact Penalty Fee.**

If the violation is discovered by the Covenants Department, in addition to being subject to any and all applicable fees and fines, you will be required to pay the After-the-fact Penalty Fee of $100 before the Design Committee will review the plan. There is **absolutely no guarantee of approval** regardless of the fee charged and/or paid. Once you submit the application, the plan will be reviewed **as if the improvement does not exist**.

If the Design Committee denies an "after-the-fact" application, the homeowner will be fully responsible to remove and/or alter the improvement as required in writing by the Design Committee. A deadline will be issued and enforced. The homeowner may pursue an appeal (see the chapter on Appeals) within the time allotted for appeals.

The method for "after-the-fact" application and submittal preparation is identical to chapter IX, 'Design Committee Application Procedures'. See your association office with any questions regarding this process.

NOTE: BUILDING WITHOUT A PERMIT DOES NOT IN ANY WAY OBLIGATE THE DESIGN COMMITTEE TO APPROVE ANY MODIFICATION IN FULL OR IN PART REGARDLESS OF THE COST TO ALTER OR REMOVE THE MODIFICATION. HOMEOWNERS WHO BUILD WITHOUT A PERMIT DO SO AT THEIR OWN RISK.

X. THE DESIGN COMMITTEE RULES & GUIDELINES

1. Non-Exempt Items

Any item not specifically listed as exempt from Design Committee approval must be applied for according to the application rules and submitted to the Design Committee as required.

2. Easement Alterations

A. For restrictions specific to your subdivision, refer to your deed. For answers to any questions or clarification, call the Ewa by Gentry Office.

B. Any mechanical improvements (a/c compressor, pool equipment) will automatically be denied.

C. Inert improvements (gravel, slabs, walkways, etc) require termite treatment. Any improvement intended to be built **on or within an easement** must be accompanied by a Neighbor's Awareness Form from the homeowner affected by the improvement. This includes party fences within easements as well. These rules apply to all easement alterations.

3. Termite Treatment Required

Soil under all new concrete slabs on grade, building floors, footings, masonry foundations, walls, patio slabs, sidewalks and driveway extensions shall be treated against subterranean termites prior to pouring of cement. A copy of the termite treatment order must be provided with the design request, or treatment certificate (receipt will suffice) must be provided following approval and installation of the concrete. No homeowner may cause any other homeowner's termite warranty to be voided by adding or doing anything to the five (5) foot easement against the recommendations and/or requirements of the termite coverage provider. Every neighboring homeowner must check with the neighbor regarding their warranty before doing anything that may affect the termite warranty within the easement. FAILURE TO DO SO MAY BRING UNWANTED AND COSTLY LIABILITY EXPOSURE TO THE OFFENDING HOMEOWNER.

Chemicals used outside any buildings on a residential lot or in accessible spaces under buildings on a residential lot shall be used with the utmost regard for the safety of children, plant life and pets.

4. Swale/Drainage Pattern/Grading

Definitions:
Swale - *The valley-like dip in a property that allows for water and rain to run off.*

Drainage Pattern - *As illustrated on the homeowner's plot plan, the arrows that indicate the path of the swale or the direction of the natural water/rain run-off.*

Surface drainage shall not be altered or obstructed. Any drainage swale altered during a modification or alteration on the lot shall be reconstructed so as to be functional. Surface runoff shall be dispersed or channeled in a manner so as to prevent erosion or encroachment onto adjacent property, and only in accordance with approved grading plans.

- No new construction will be allowed that does not clearly establish a proper drainage flow of water/rain run-off.
- No after-the-fact improvement shall be approved until all swale and drainage pattern conditions have been re-established according to the original swale/drainage pattern.
- No construction or improvement will be permitted or approved that affects or impacts water/rain runoff and drainage patterns on the property.
- No exceptions.

Grading - An Owner shall accept the condition of the lot as is and shall be responsible for the maintenance of the lot, including wind and water erosion control. After the lot is accepted, all grading, excavation, fill and site work required shall be done only in accordance with approved drawings submitted to and approved by the Ewa by Gentry Design Committee prior to any site work and shall be completed at the expense of the Owner. Fill material brought to the site shall be free of adobe, termites and deleterious matter. The Owner shall obtain a grading permit for cuts and fills as required by ordinances of the City and County of Honolulu, and shall abide by all City & County Ordinance requirements. All graded areas shall be landscaped.

5. Excavation

Whenever an Owner excavates within a lot, the Owner shall ensure it does not adversely affect the drainage of any adjacent properties. Whenever excavation creates an unstable bank condition, or potentially unstable bank condition, the Owner shall take appropriate action to control and retain said embankment. Excavation that creates an excessively high and unsightly retaining wall may be disapproved by the Design Committee.

6. Fill

Whenever the Owner seeks to fill the lot, the Owner shall ensure it does not adversely affect any adjacent properties. Whenever fill creates an unstable or potentially unstable bank condition, the Owner shall take appropriate action to control and retain said embankment. Fill, which, in the judgment of the Design Committee, creates an extremely high and unsightly retaining wall may be disapproved. Whenever fill or excavation requires the construction of a retaining wall, it shall be the Owner's responsibility to install and maintain said retaining wall. Further, wherever fill or excavation causes destruction of existing draining swales or natural drainage patterns, it shall be the Owner's responsibility to restore such swales and drainage patterns or to otherwise provide for adequate drainage.

7. Landscape

Landscaping by definition refers to living material. The design intent for the Ewa by Gentry Community is for homeowners to create and maintain a planted landscape theme, with wide use

of xeriscape design and appropriate plants to minimize water consumption and maintenance labor.

The Owner shall landscape the front, back yard and planting strip(s) between the sidewalk and the street or curb line within three (3) months after closing. The use of non-living or inert materials is acceptable if 50% of the yard is planted. Inert material may not exceed 50% of the entire plantable yard, including front, side, and rear yards and it may not be concentrated in one area; ***it must be evenly distributed throughout the entire lot*** *(see Inert Material Rule & example, Illustration 22)*. If you plan to install any inert (non-living i.e. rock, gravel, concrete) material in your yard or planter strip at the front of your property, you must first consult either Ewa by Gentry office or the City & County of Honolulu for the planter strip. Large or numerous lawn decorations (YARD ART) and/or statues are subject to approval by the Design Committee.

Whether xeriscape is used, or grass is used in general, the following rules apply:

- Any return walls (also called 'cross walls') must include shrubs to soften the harshness of the inert material.
- The planter strip at the front of your house must be planted and maintained along with the yard, on a regular and consistent basis.
- Concrete, gravel, wood chips or pavers are considered 'accents' to a landscape and not a landscape in themselves.
- No buckets, pails, cans, or other containers may be used for planting pots. No more than ten (10) neat and attractive planting pots may be used where visible to the street or neighboring property. Pots must be all in one color.
- A height restriction of thirty inches (30) will be used for all hedges that are planted to serve as a property boundary.
- **UNDER NO CONDITIONS WILL ARTIFICIAL TURF BE ALLOWED AS A PART OF ANY LANDSCAPING FOR ANY REASON.**

NOTE: The above conditions, limitations, and restrictions on improvements are subject to Design Committee review and there are also specific uses and restrictions as described in the DCC&R's to which the homeowner must comply, or a violation notice can be issued by the Covenants Manager.

8. Trees & Bio-barrier

Article IV, Section 4.02, item (d), line 7 of the DCC&R's states *"unless the prior approval of the Design Committee is obtained, no trees shall be planted within ten (10) feet of a property line and no trees planted by the Declarant or a Subdeveloper within ten (10) feet of a property line shall be removed or cut down."*

Homeowners are to apply for any type of tree that is to be placed on the lot. Homeowners are discouraged from planting aggressive rooted trees or trees that attract pests such as bees and termites (*see "Recommended Plant List" on page 53*).

Upon approval, root barrier or bio-barrier maybe required to be installed to control the growth of the roots and prevent them from damaging fences, foundations and neighboring property.

The canopy of the trees must be trimmed and maintained in perpetuity, in a manner so as to ensure that no part encroaches onto any neighboring property at anytime.

The following rules adopted by the Director of Parks and Recreation of the City and County of Honolulu by authority of Ordinance 3738 adopted June 2, 1971 apply to all streets owned by the City and County within the Ewa by Gentry area.

A. *The Director shall be responsible for the enforcement of provisions regulating the planting and maintenance of street trees and shall issue all permits required hereunder to replace, remove, plant, spray, trim, and prune street tree.*

B. *The Director may trim obstructing or hazardous portions of any tree standing on private property which overhangs or projects into a street.*

C. *The Department shall perform all general maintenance of street trees; however, the abutting property owner shall be responsible for watering and weeding area around trees.*

D. *It shall be unlawful for any person to prune or remove trees growing in the planting strip, without first obtaining a permit from the Director, provided, however, that in emergencies; the Traffic Engineer of the City & County of Honolulu may, at their discretion, remove trees.*

E. *It shall be unlawful for any person to plant trees in the planting strip without first obtaining a Street Tree Planting Permit from the Director. When as excavation permit is required by the Department of Public Works prior to the planting of a tree, the applicant shall obtain said permit prior to his application to the Department for a Street Tree Planting permit.*

F. *It shall be unlawful for any person to injure or destroy trees in the planting strip in any manner or by any means, including but not limited to:*

   (1.) Constructing a concrete asphalt, brick or gravel sidewalk or otherwise filling in the ground area around any tree so as to shut off the air or water from the roots.
   (2.) Piling building materials, equipment or other substance around any tree so as to cause injury.
   (3.) Pouring any deleterious or poisonous matter on or around any tree, or on the ground, sidewalk or lawn.
   (4.) Posting any sign, advertisement, or notice on any tree, tree stakes or guard or fastening any guy wire, cable, or rope to any tree, tree stake, or guard; provided, however, that under supervision of the Director, warning, traffic and official notices may be temporarily installed or placed on tree trunks.
   (5.) Damaging any tree, tree stake, or guard with a vehicle or animal, or in any other manner causing injury to any tree.
   (6.) Transplanting or removal of trees necessitated by widening or relocation of driveway or by any other construction by the owner of abutting property shall be done at the expense of the owner of abutting property after said owner has obtained a permit thereof from the Director. Wherever the owner removes a tree which for any reason cannot be transplanted, he shall replace said tree with a new tree where the Director determines that the planting of said new

tree is feasible. The Director may require a deposit or a performance bond in such amount as will guarantee the satisfactory completion of said transplanting or removal and may require the permittee or his contractor to procure an insurance policy for property damage and public liability naming the City & County of Honolulu as an insured party with limits of coverage in such amount as will reasonably protect the City from any liability consequent upon said transplanting or removal.

Penalty – Any person violating any provision of these Rules shall upon conviction be punished by a fine not exceeding $500 or by imprisonment not exceeding six months, or by both.

9. Walls, Fences and Gates

Approval is required for all fence, wall and gate construction.

A. Neighborhood Specific Restrictions

PLEASE NOTE: There are NEIGHBORHOOD SPECIFIC restrictions that apply to Sun Terra, Soda Creek, Carriages and Woodbridge. They are as follows:

Soda Creek Restrictions (Cluster Development No. 87/CL-11)

(1.) Front yard fences:

a. All fences and walls over thirty (30) inches high must be set back three (3) feet minimum from front yard property lines except along only one side for corner lots and along Kolowaka Drive. The three-foot setback must be landscaped.

b. Fence colors shall be subdued earth tones and front yards shall be landscaped except for necessary drives and walkways.

(2.) Fencing at corner lots:

a. Replacement of existing fences at front property line, where building permits were previously issued, may be replaced at the same location with the approved fence design.

b. New fences and walls at the front property line for corner lots shall be permitted along one side of the street frontage. A minimum three (3) feet setback shall be provided on the other side.

c. All fence locations; heights, type, and color must be approved by the Ewa by Gentry Community Association Design Committee and may require DLU (Department of Land Utilization) approval. This restriction shall continue in perpetuity.

(3.) Lot Coverage and Trellises:

Building coverage shall not exceed 50% of the zoning lot area; however, trellises over 50% open to the sky may be added with a building coverage of all buildings and structures, including trellises, not to exceed 80% of the zoning lot area and subject to approval by the Director of Department of Planning & Permitting.

(4.) Improvements in Use Easements:

Improvements, not to exceed thirty (30) inches high, are permitted in use easements. Approval should be obtained from both the owner of the use easement and the property owner of the land on which the easement is located and subject to design Committee Approval and Director of Land Utilization.

(5.) Second Story Additions:

Second story additions are permitted, subject to compliance with yards and height setbacks of LUO requirements for R-3.5 residential district and review and approval by the Department of Planning & Permitting.

Blanket Approval for Soda Creek Roofing Material and Color:

The committee at their July 30, 2007 meeting unanimously approved a blanket approval to have homeowners in the Soda Creek neighborhood choose Architect 80 Birchwood or Country Gray. All other roofing material will be reviewed on a case-by-case basis by the Committee. A pre-approved roofing form must be completed and filed with the Association office prior to installation. Please contact the Association office for more information or to view the roofing sample.

Sun Terra Restrictions (Cluster Development No. 91/CL-7)

(1.) Solid fences and walls within the required front yard of each unit, except along major streets, may be constructed up to the front property line of each lot not to exceed a maximum height of twenty-four (24) inches. Please note that in most cases the property line occurs as a setback of three (3) feet from the sidewalk. That setback is owned by the City & County as part of the public right-of-way and must be maintained by the Homeowner.

(2.) Painted or prefinished metal open (see through) picket fences may be constructed above solid walls within the required yard, not to exceed five (5) feet above existing grade.

(3.) Picket fences shall consist of vertical round rods or square bars set in a series with no less than a 4-inch clear space in between. Vertical supports for picket fences shall not exceed two (2) inches square or diameter.

(4.) Masonry screen block, chain link or wood slats will not be acceptable substitutes for "see though" picket fences. Designs for picket fences shall be simple and not overly ornate.

(5.) Existing planting strip and required street trees within the City right-of-way shall not be reduced, removed or relocated without prior approval from the Department of Land Utilization. They shall be landscaped and maintained by the individual homeowners. Structures of any kind, including rock piers for mailbox supports, are not allowed within the City right-of-way.

****As a reminder, though walls 30 inches or less in height are not required to obtain building permits, approval by the Department of Land Utilization may be required to verify compliance with the Cluster conditions. Failure to obtain DLU approval prior to constructing walls and fences, or the removal of street trees without such approval may result in civil fines.*

Carriages Restrictions:

(1.) All fence and wall designs, regardless of height, must be submitted to the Ewa by Gentry Community Association Design Committee for review and approval. In addition to the plans for the wall construction, specifications on materials, finish and color must accompany all Design Committee submittals. The use of wood, vinyl, and chain link fence materials are specifically prohibited.

(2.) All fences and walls shall be constructed out of cementatious wallboard, CMU (hollow tile), CRM (rock or lava rock) or brick. Brick veneer or other kinds of rock and brick finishes are acceptable. Cementatious wallboard and CMU fences must be finished with a plaster or sand finish. Wrought iron may be used in limited circumstances and will be evaluated as to its design appropriateness on a case-by-case basis by the Design Committee. GOOD SIDE OUT is required for all finishes, whether visible to the street ort neighboring property. EXAMPLE: A CMU wall with rock veneer on the **inside** of a lot must be finished with a plaster or sand finish on the **outside.** You cannot show your neighbor or the street an unfinished wall or fence. An exception to the finish would be to use split face on the outside.

(3.) All fences and walls must be painted to match or complement the home.

Woodbridge Banyan Model Driveway Gate Restrictions:

Woodbridge Gates - The Committee members unanimously decided to approve the following criteria in regards to solid gates, which cross a driveway, *criteria to be specific to Plan 2 type homes at Woodbridge I & II only*:

(1.) Gate shall open inward or sideways
(2.) No exposed hinges shall be visible from the street
(3.) Gate shall be manual in operation
(4.) Fence and/or gate shall not extend beyond the façade of the house
(5.) Gate shall match the existing fence
(6.) Special or custom gates (overly ornate) will generally not be approved but will be reviewed on a case-by-case basis.

B. Walls & Fences (Applies to all neighborhoods)

Section 4.02, Article D, Item 9 of the Ewa by Gentry DCC&R's states the following:

> *"any fence or wall located within twenty (20) feet of a property line facing street shall be of lava rock, split-face block, stucco, brick or used brick with raked joints or siding which matches the exterior colors and materials of the dwelling unit or shall be of such other designs and materials approved by the Design Committee."*

(1.) **Planting strip outside a fence or a wall** – The Owner is responsible for maintenance of the area alongside a wall or fence within the Owner's lot. This requirement shall be a condition of approval for the construction of all walls and fences adjacent to the front, side and rear property lines of all lots.

(2.) **Property pins** – It is the Owner's responsibility to verify the location of property pins before and after completion of any perimeter wall construction or improvement. Pins should not be removed under any circumstances.

(3.) **Height** - A solid fence or wall, excluding retaining walls, constructed along or within ten (10) feet of the street frontage of a lot shall not exceed thirty (30) inches maximum height. However, "open-style" fencing, such as wrought iron or open picket style vinyl fencing may be added to the thirty (30) inch wall within the ten (10) foot setback for a total maximum combined height of six (6) feet from finished grade. Open fencing should be kept to a simple design. The maximum height of walls and fences may not exceed six (6) feet. In addition, where practical, the height of any proposed fence, wall and gate shall not exceed that of any existing walls and fences on adjacent properties, i.e., the height of fences, walls and gates on adjacent properties shall be identical.

(4.) **Footings** - Footings for fences, walls, and gates including post holes shall be entirely within an Owner's lot and shall not encroach upon an adjacent property unless by specific written agreement between the two property Owners.

(5.) **Setbacks** – All solid wall and fences over thirty (30) inches in height must be setback ten (10) feet from the front property lines. For properties abutting two or more streets, the above setbacks will apply only to the property line on the front face of the house on the lot. All fences or walls, whether solid or of the "open-style", must be approved by the Design Committee. The finished colors of any wall or fence must be submitted with the original request and be approved by the Design Committee, unless specifically allowed.

(6.) **Materials:**

a. Fences and retaining walls located within twenty (20) feet of a property line facing the street may be constructed of lava rock, split-face block, interlocking cement blocks and may be painted to match the residence. Plain block may only be used if stucco finished. Any proposal to paint a wall must include filling in all grout lines and painting with a heavy body paint which must conceal the block beneath. Used brick with raked joints may also be used. Fences may be made using siding which matches the exterior color and materials of the dwelling as approved by the Design Committee.

b. In general, walls, fences and gates, containing one or two materials appropriately mixed, may be approved. However, walls, fences and gates containing more than two materials and those using reflective materials, such as, expanded metal, plastic, fiberglass or exotic designs, shall not be approved unless they tie in with overall design and decoration of home. Request will be reviewed on a case-by-case basis.

c. Chain link fencing is not an acceptable material and shall not be approved.

d. All gates must inherently match the fencing in design, color and materials. Overly ornate or garish fences and gates will not be allowed. All gates require Design Committee approval and are not automatically approved. If a gate is not submitted with the original request, it must be submitted and approved prior to installation. A photo or accurate sketch of the proposed gate must accompany all gate applications.

e. No part of any wall or fence, including the fence posts, should touch or connect to your house or your neighbor's house, wall or fence. There must be a minimum space of at least three (3) inches between these structures.

(7.) **Design** - The Design Committee will grant approval to wall and fence designs that blend in with the overall community sense of simplicity. Simple fences with flat tops are preferred. Overly ornate walls, fences and gates are discouraged. The Design Committee will not approve baluster walls or overly ornate wrought iron fences and gates. For safety purposes, walls and fences may not obstruct your neighbor's view from their driveway.

(8.) **Existing Walls and or Fences on Neighboring Properties -** All Owners planning to construct fences, walls, or gates on their property shall indicate on their plans the location, heights and type of material of any existing walls and/or fences on adjacent properties.

(9.) **Fences and walls exempted from all of the above conditions and exceptions to the three (3) feet front yard setback are as follows:**

a. Existing walls or fences located within existing setback areas, which have **received previous written design approval**
b. Fences originally placed by the Developer
c. Side yard on corner lots where the street is less than two hundred (200) feet long

(10.) Fences in neighborhoods with redwood fences, may be painted within the lot, including the side and rear fences, provided that they are painted to match or complement the body of the house, and provided that they are not visible to the street or adjacent property.

(11.) Front fences of redwood facing the street or common area must be painted to match the body of the house, and the trim may be painted to match the trim of the house, provided that the color of the house is an approved color or was submitted and approved by the Design Committee.

NOTE: To prevent dislocation and/or collapse, all wall, fence and gate work must be completed in a professional and workmanlike manner, and meet all City & County building codes. A copy of the City & County permit must be submitted prior to the construction of all walls and fences.

C. Good Side Out of Fence, Wall, or Gate

(1.) Whenever a fence, wall, or gate, by the nature of its construction and materials has a "good side," the "good side" shall face outward from the property toward the adjacent street, etc. Any exposed framing, braces, support material, etc. shall face inward to the property and may, at the Owner's option, be finished with an approved material.

(2.) When constructing a CRM Rock Wall (composite rock material), the same material shall be used throughout the entire wall thickness.

(3.) All jagged edges shall be smoothed, tooled and skilled. This includes the grouting and mortaring in between each rock. Jagged edges on the rocks shall be avoided and monitored by the Owner.

D. Parallel Walls/Fences (two walls built along side one another on neighboring properties)

(1.) Generally, construction of parallel walls shall not be approved because they contribute to visual clutter. However, due to the varying needs of adjacent neighbors, the Design Committee may approve parallel walls on a case-by-case basis.

(2.) Joint Ownership and Maintenance Agreement - Whenever two adjacent Owners agree to jointly construct a fence or a wall along and over a mutual property line, it is required that a Joint Agreement for Construction and Maintenance be prepared, signed, recorded, and a copy submitted with the Design Committee Application Form.

(3.) Footings shall be entirely within an applicant's property unless there is a Joint Agreement for Construction and Maintenance with the adjoining property Owners.

10. Additions, Enclosures, Patios, Trellises, Remodeling, and Renovations

A. All plans for additions, enclosures, patios, trellises, remodeling and renovations must be submitted to the Design Committee for approval (*see page 14 for penalty for building without prior Design Committee approval*).

1. All additions and enclosures must utilize similar or same materials as existing (i.e. siding, trim, windows, doors, roofing, etc.) All details, trim and colors shall be in appropriate scale and tone to the existing dwelling.

2. All improvements must be consistent with the architectural concept of the existing dwelling in style and roof slopes. No roof shall exceed thirty (30) inches of

overhang on any neighboring property. No drastic differences will be approved. No exterior stairs will be approved.

3. Wherever a room is added to an existing residential structure, exterior siding, window design and door details shall match the original or existing structure. The height of all openings for windows and doorframes shall match those of the existing structure.

4. Extending structure walls along the use-easement side of a residence must ensure the existing privacy of the adjoining lot, especially pertaining to windows.

5. All extensions, additions and patios will be subject to all City and County Building Codes and setbacks. Homeowners are responsible for obtaining their own City and County Permit. The Association will not release the approval permit until a copy of the City and County Permit is submitted.

6. When reviewing a plan for a concrete lanai slab, the Design Committee shall consider the potential future covering or enclosing of said lanai slab to determine if such addition can be made without compromising the exterior appearance of the dwelling.

7. Roofs – New roofs must conform in design and materials to the existing structures within each neighborhood. If not using existing materials, the material to be used must be called out on the original submittal.

8. A Design Permit is not required to simply repair or replace a portion of roofing material, provided the same type of material currently on the roof is used and the repairs do not in anyway alter the exterior appearance or roofline of the residence.

9. Built-up roofs shall be approximately flat with a slope of not more than two (2) to twelve (12) inches.

10. Flat roofs may be finished with built-up tar and gravel in colors of dark brown to red-brown or gray to blue-gray only. Flat top roofs, shed roofs or roofs with a lesser pitch than the existing dwelling are permitted provided that:

    (a.) It is not visible to the street and/or neighboring properties
    (b.) The Neighbor's Awareness Form is submitted from all adjacent & abutting neighbors.
    (c.) No roof shall exceed thirty (30) inches overhang of any neighboring property.
    (d.) City & County approval must be secured and submitted prior to construction.
    (e.) Homeowners must comply with all other Design Committee and City & County existing rules, regulations and requirements.

11. Shake or wood shingle roofs shall slope a minimum of three and a half inches in twelve inches (3-1/2" in 12") for eaves and four and a half inches in twelve inches (4-1/2" in 12") for roofs over the main structure.

12. Metal or plastic corrugated roofing material may not be used and shall not be approved.

13. Standing seam and corrugated metal roofing may not be used and shall not be approved.

14. Any metal tile ('Met-tile' type) roofing will be considered on a case-by-case basis.

15. If installing skylight - Approval is required for the installation of skylights. High-profile skylights (over five (5) inches) will be reviewed on a case-by-case basis. 'Bubble' type skylights are limited to a maximum of three (3) per dwelling and two (2) per any one section of the roof. Framing must be painted to match the existing roof materials and be in line with the direction of the roof with a minimum of four (4) feet back from the edge of the roof.

16. Carports may be added to any lot to provide additional parking subject to existing size of lot, and will be reviewed strictly on a case-by-case basis.

17. All materials must appear new and be termite, rot, rust and fungus free. Although recycling is encouraged, no obviously used materials will be approved. Tarps of any color are prohibited on a temporary or permanent basis and must not be applied to any part of any house, storage, accessory structure, barbeques, sheds, kennels, awnings, vehicles, etc.

B. In addition to the above requirements, the following are guidelines for installing other concrete work on residential lots: Design Committee Application Forms for installing any concrete on residential properties are required and shall be reviewed on a case-by-case basis. The following shall apply:

1. Termite treatment shall be required under all new concrete work. The Owner shall furnish proof of such termite treatment.

2. Driveways may be widened by a maximum of three (3) feet, in any combination to either side to equal three (3) feet (i.e. 1 ½ feet per side, 3 feet to one side, etc.) unless that width encompasses the distance to the property line, and then a two-foot planter strip must be provided. No driveway may be widened or altered without Design Committee approval. Owners who do so may be required to remove all illegal concrete at their expense.

3. If the driveway has been widened subsequent to its original construction by the developer, the Design Committee may not approve additional widening based on the determination by the committee that such addition compromises the exterior of the residence.

4. In general, other concrete work, such as walkways abutting the original house slab shall be approved providing that the slabs and walkways leave adequate room for landscaping, particularly at the front of the residence or facing the street.

5. All concrete must be installed by industry standards with a minimum thickness of four (4) inches and adequate reinforcement.

6. Concrete additions are subject to the 50% inert material rule (Rule #7) and will require an area tabulation (see sample on back) to prove compliance.

7. Standard setback from all property lines is two (2) feet for purpose of maintaining the surrounding fence. It shall also serve to provide access for repairs and to ensure that some green space is established, and to provide for drainage.

8. If the concrete interrupts the drainage pattern, the plan must address the re-routing of the drainage and it must be approved by a licensed engineer.

9. Wall to wall concrete is not permitted. Any time concrete is designed to meet a proposed or existing wall, a two-foot planter strip must be provided for landscaping to soften the concrete.

C. The Design Committee also unanimously agreed to pass a rule for **Carriages** Homeowners. The maximum driveway extension allowed for any Carriages homeowners will be the extension of the third car garage if the option of the concrete slab was not poured by the Developer and must meet the criteria below:

1. The option of the third car garage is for garage use, not for a bedroom use.

2. No driveway extension regardless of width will be allowed on the opposite side of the driveway. Such side yard will be reserved strictly for landscaping.

3. Gravel may not be used as a driveway extension.

4. Pavers or stepping stones placed next to the driveway will be considered as part of the maximum extension allowance. If a brick pathway is desired along with the driveway extension, the committee will dictate the setback between the extension and pathway.

11. Awnings

Metal or corrugated awnings or tarps in general will not be approved by the Design Committee. Requests for retractable awnings with other types of material will be reviewed on a case-by-case basis. Color and design must compliment the color of the house and must be in its retracted position when not in use. Permanently deployed/non-retractable awnings will not be allowed.

12. Second Story Additions

Single-story residences not designed for a second-story addition generally encounter architectural and structural problems which are difficult to overcome. Detailed review will be required to determine issues of open space, view planes, roof lines and architectural compatibility with existing homes in the same neighborhood, architectural compatibility with the existing dwelling, and other considerations.

In addition to all of the provisions of Rule #10, all plans for second story additions, elevated decks or balconies must show that there will be no adverse impact on the adjacent properties with respect to loss of light, view, and privacy.

13. Painting – Exterior

Paint Procedures – Effective July 18, 2003

A. Homeowners shall pick from the approved color schemes for their respective subdivision. Contact the EbGCA office for more information.

B. Homes previously approved and painted with different or custom colors must repaint, when re-painting becomes necessary, with approved schemes as stated above.

NOTE: No splattering, sponging or any other decorative paint application will be considered for any garage door, front door, trim or any part of any house.

All garage doors shall be painted one solid color. Color is pre-determined by the color scheme selection.

Homeowners must complete a **"Pre-approved Paint Form"** available at the Association's office or on our website at www.ebgca.net and must receive a signed confirmation by the Staff prior to repainting. Painting without filing the proper paperwork and using colors other the pre-approved colors available for review at the Association's office will result in a covenants violation and will be subject to fines and other penalties. Such penalties may include repainting with a pre-approved color.

14. Painting of Driveways & Walkways

Driveways may become soiled in time and therefore need cleaning. Homeowners may also wish to resurface driveways and/or walkways with a non-skid product. In any case, a Design Committee application is required. Any application of a new surface or paint must be of a color, which matches the natural color of concrete, and/or clear coat and must be maintained in perpetuity from fading and normal wear and tear.

Under no conditions will paint or product of a different color be approved. The only color selection shall be that of concrete.

15. Swimming Pools, Spas, Hot Tubs, Ponds & Jacuzzis

Plans for outdoor swimming pools, hot tubs, spas and other similar structures shall be submitted to the Design Committee for approval, and must meet the following requirements:

A. Swimming pools constructed above grade (on the ground) shall be allowed provided they are not visible from the street or neighboring property.

B. Swimming pools constructed below grade (below the ground) and are visible from the street may be approved provided the Owner complies with the rules for grading, walkways, drainage, etc.

C. Swimming pools visible from neighboring properties or streets may be permitted provided that the Design Committee finds it to be aesthetically acceptable and does not disrupt the quiet enjoyment of any adjacent neighbors.

D. No swimming pool plan will be approved without a valid engineering stamp.

E. Pool Equipment Enclosure – An enclosed structure is required around all pool equipment (pumps, filters, accessories) to ensure the quiet operation of the equipment.

F. Filter Noise – Applicants seeking approval of swimming pool plans must submit details for abatement of filter and skimmer noise. The pump, motor, filter, and skimmer unit(s) shall be soundproofed as part of the installation of the unit to prevent nuisance to the residents of adjacent properties. If, after installation of the unit, the Design Committee determines that noise from the operation of the unit disturbs the adjacent residents, the owner must immediately provide sufficient additional soundproofing. Notwithstanding the Design Committee's right to approve and require adjustment to the filtering unit, the Owner shall assume full responsibility thereof and shall hold the Design Committee harmless against any and all claims resulting from the maintenance and operation of the filtering unit.

G. Swimming pool or Jacuzzi covers must match the color scheme of the home. **NO BLUE, SILVER, GRAY, GREEN, ETC., TARPS ARE TO BE USED UNDER ANY CONDITIONS.** Only custom made covers or standard order covers must be used at all times.

H. Operating Requirements. The Owner shall, at all times, comply with all Department of Health rules, code and regulations concerning the operation of a private swimming pool.

I. Lighting. Refer to Rule #37, "Exterior Lighting". In addition to the foregoing, the Design Committee may approve appropriate underwater lighting in those instances where the source of light is not visible from adjacent properties.

J. Solar Water Heater System. Refer to Rule #18 for solar water heater guidelines. In addition, if more than two panels are planned, the homeowner must submit to the Design Committee for review and approval.

16. Water Feature, Water Falls and Fishpond Structures

Fishponds, water features and structures, incidental or typical to landscaping, require approval by the Design Committee, shall be reviewed on their individual merit, and shall comply with the following:

A. Maximum Dimensions:

(1.) Depth: Sixteen (16) inch maximum water depth.

(2.) Height: Counting the distance from the top of the structure, with all cascading waterfalls, urns, statues, and static displays, the heights are as follows:

a. Front Yard: Total maximum allowable height shall be limited to thirty (30) inches.

b. Back Yard: Total maximum allowable height shall be limited to six (6) feet in height.

c. Width: A surrounding edging or concrete coping shall be limited to a maximum width of thirty-six (36) inches.

B. Location: Water feature structures are required to be located outside of the five (5) foot setback area from each side and back property lines, and ten (10) feet from the front property lines.

C. Accessories: All feeding boxes, water supply lines, cleanouts, and filters shall be concealed from view.

D. Lighting: All ground lighting shall follow the lighting rules (refer to rule #37).

E. Shading: Shade cloths over the fishpond shall be reviewed and may be approved behind the front plane of the house.

F. Water Disbursement: Rain overflow water shall be contained within the boundaries of the property.

G. Exception: A stand-alone fountain with a maximum height of six (6) feet, located in the backyard, and not visible from the street or neighboring properties, may be installed without a Design Permit.

H. Water Features Incorporated into a Wall or Natural Free-Standing Waterfall: A water feature, incorporated into a CRM moss rock wall or natural free-standing waterfall that exceeds a height of thirty (30) inches is not permitted within the setback areas.

17. Gable Vents, Solar Powered Roof Vents, Solar Powered Turbo Vents, Skylights, Fireplaces, Weathervanes

The Owner shall attempt to minimize the adverse appearance of vents by installing them below the ridgeline of the roof and in those portions of the roof or side of house not facing the adjoining street.

Gable Vents:

All replacement gable vents shall match the original design or as close to the original design as possible and painted either white or the prescribed color of the trim. No ornate designs will be allowed.

Solar Powered Roof Vents:

All turbo vents or similar roof vents shall be installed below the ridgeline of the roof and in portions of the roof not facing the streets, and shall have no reflective materials.

Skylights:

The same rules apply to skylights except placement on the roof. All skylight installation placements will be reviewed on a case-by-case basis based on the design of the skylights and how the design ties in with the overall house design.

Fireplaces:

Fireplace chimneys must meet all fire code requirements and be compatible with the overall community and house design. They will be reviewed on a case-by-case basis.

Weathervanes:

Due to the subjective nature of weathervanes, they will not be approved under any conditions.

Roof Mounted Power Attic Ventilator Fans:

The size and spacing required for roof mounted power attic ventilators shall be determined by the size of the roof and located in a linear manner along the roof.

The vents shall be self-flashed and shall prevent lateral moisture infiltration. Any other roof accessories, located in areas visible to the street and neighboring property, must be compatible with the color of the roofing material on which they are located.

The roof mounted power attic ventilators shall be as inconspicuous on a roof as much as possible.

The roof mounted power attic ventilators must be mounted with edges parallel to the edges of the roof on which they are located.

The ventilator shall feature a thermostat to monitor the buildup of heat in the attic.

18. Solar Units

All solar panels must be **"flush mount"**, no closer than two (2) inches to the roof and no higher than six (6) inches from the roof. **Racking of any panels higher than six (6) inches is prohibited.**

A. Thermosyphon systems (systems having the water storage tank as an integral part of the unit) shall be positioned on the roof in an area of least visibility from the street. Homeowner must be sure that contractor/installer verifies with an engineer

that the roof is structurally capable of supporting the water tank when full. The tank must be painted to match the color of the roof.

B. All other tanks shall be placed within the residence interior walls. All visible piping must be wrapped and painted to match the surface to which it is attached. **No piping may cross the roof ridge.**

C. All systems shall be positioned on the roof so that no portion of the solar unit extends above the ridgeline of the roof.

D. Hot water runoff caused by venting from the system's relief valve shall be prevented by the installation of a drain line, if necessary.

E. The amount of visible piping shall be minimized to reduce the possibility of the roof having a cluttered appearance.

F. All solar units installed by the developer must adhere to these rules.

19. Antennas and Satellite Dishes

Antennas/Satellite Dishes:

Article IV, Section 4.02, Item d, line 11 of the DCC&R's states that "no television or radio antennas shall be erected on the roof of any dwelling unit or outside of any dwelling unit so as to be visible from neighboring property or street."

The above provisions of the governing documents of Ewa by Gentry restrict installation of antennas. These restrictions shall continue to apply to all installations of antennas except to the extent modified by the FCC OTARDR Rule, Telecommunications Act of 1996. Any broadcast antennas (e.g., ham radio antennas) shall continue to be subject to the existing restrictions in the governing documents and existing rules.

A. A mast, antenna or satellite dish may only be installed on property which is within the exclusive use or control of the user where the user has a direct or indirect ownership interest in the property. Installation in other areas is not permitted.

B. Antennas and masts shall not be installed, used, or maintained on or in the common areas of EbGCA.

C. Antenna or mast shall not encroach upon any common area, another Owner's lot or home site, the airspace of common areas, or another Owner's airspace.

Antenna Installation Affected by the FCC Rule:

These guidelines for the installation of antennas and satellite dishes are adopted by the Design Committee of EbGCA in conformance with the rules of the Federal Communications Commission (47 C.F.R. Part 1, subpart S 1.4000 et seq.)["FCC Rule"] governing installation of direct broadcast satellite antennas, multipoint distribution system ("wireless cable") antennas and over-the-air broadcast antennas. Design acceptance is required for the following types of antenna and satellite dishes.

A. Antennas designed to receive direct broadcast satellite service, including direct-to-home satellite services, one meter or less in diameter, or 39.37", or the maximum measurement allowed by the FCC.

B. Antennas designed to receive video programming services via multi-point distribution services, including multi-channel multipoint distribution services, instructional television fixed services and local multipoint distribution services, otherwise known as "wireless cable" services, one meter or less in diameter or diagonal measurement; or

C. Antennas designed to receive over-the-air television broadcast signals.

Restrictions on Antenna Installation Affected by the FCC Rule:

Antennas covered by the FCC Rule shall be installed only in accordance with the following restrictions:

A. An Owner proposing to install an antenna shall submit the EbGCA Notice of Intent to Install an Antenna/Satellite Dish to the EbGCA Design Committee prior to installation. The notice shall include:

(1.) The type of antenna to be installed.
(2.) The date of the intended installation.
(3.) The location of the intended installation.
(4.) If the antenna or satellite dish will be mounted on a mast (pole), then a Design Permit is required.
(5.) A written documentation from the service provider detailing the reason if a homeowner is requesting for more than a total of two (2) dishes to be installed on their lot at any given time.
(6.) Any permits or licenses required by city, state, or federal law.

B. Provide two copies of the property plot plan showing: location of the mast and how it is anchored. Structures larger than thirty (30) inches may not be placed within the five (5) foot setback area from the property line.

Note: NO APPLCIATION WILL BE CONSIDERED WHICH LACKS REQUIRED PERMITS AND/OR LICENSES.

EbGCA Consent: Subject to the provisions herein, antennas shall be installed, used and maintained in the lots (as defined in the Declaration); provided however, that no antenna shall be installed, used, or maintained on any lot, without the prior written consent of the design Committee, if the installation, use, or maintenance shall involve a penetration through, alteration of, addition to, or modification of any area that is not within the exclusive use or control of the antenna user and/or that the Association is required or permitted to repair and/or maintain.

Quality of Signal Reception: If acceptable quality signals can be received by placing antennas and masts inside an existing dwelling without causing an unreasonable delay or an unreasonable increase in cost, then outdoor installation is prohibited.

Conditions of Location: In any event, antennas and masts shall be placed in locations which are not visible from neighboring properties or public rights of way unless such placement would impair the installation, maintenance, or use of the antennas, in which case the following requirements shall apply:

A. Antennas and masts shall be placed in the least visually obtrusive location, which would not preclude reception of an acceptable quality signal.

B. Antennas or masts shall not extend beyond a railing or fence unless no acceptable quality signal may be received from the antenna's location.

C. Antennas placed on the ground and visible from the street, neighboring properties or public rights of way shall be camouflaged by existing landscaping or fencing, if such placement insures receipt of an acceptable quality signal.

D. If no landscaping or screening exists, the Design Committee may require antennas to be screened by new landscaping or screening of reasonable cost in such a manner as to blend with surrounding background surfaces or to minimize visibility of the antennas.

E. The antennas and masts shall be painted to blend with the surrounding background surfaces to the extent that this shall not preclude reception of an acceptable quality signal. No bare metal shall be visible.

F. Exterior antennas shall be installed so as to be minimally visible.

G. Antennas and masts shall be no larger nor installed higher than is absolutely necessary for reception of an acceptable quality signal. As used in this Antenna Installation Guideline, "...preclude reception of an acceptable quality signal..." means that reception would be impossible or would be substantially degraded.

Maintenance and Repair of Antenna: An Owner shall not permit antennas or masts to fall into disrepair or to become safety hazards. The Owner shall be responsible for maintenance and repair of antennas and masts and shall be responsible for repair or replacement if the exterior surface of the antenna or mast deteriorates.

Safety and Compliance with Government Regulations

A. Antenna installations shall not present any safety concerns and shall comply with all applicable statutes, codes, ordinances rules and regulations promulgated by any governmental authority, including, without limitation, the obtaining of any permits required by such authorities unless those statutes, codes, ordinances rules or regulations have been preempted by the FCC Rule. Installation of antennas and masts that present potential safety concerns shall require compliance with the normal application process.

B. The FCC has recognized that masts higher than twelve (12) feet may present safety concerns. Safety concerns may also be presented by installation of any mast whose height exceeds the distance to neighboring property or public rights of way measured from the point of installation. The Design Committee shall approve installation of such masts. Any application for these masts shall include a detailed

description and anchorage of the antenna and the mast, as well as an explanation of the necessity for a mast higher than twelve (12) feet.

C. If the installation shall pose a safety hazard to Association residents or personnel, then the Design Committee may prohibit such an installation. The notice of rejection shall specify the safety risks. The purpose of this rule is to address safety concerns relating to wind loads and the risk of falling structures.

D. Antennas shall not be located in the vicinity of electrical power lines or other electrical or power circuits and in no event shall antennas or masts be placed where they may come into contact with such power lines and circuits. In order to prevent electrical or fire damage, antennas shall be permanently and effectively grounded. Antennas are required to withstand winds of eighty (80) miles per hour.

Owner Permission for Tenant Installation: A tenant wishing to install an antenna or mast shall seek permission through the Owner.

Association Right to Adopt Restrictions: Pursuant to the FCC Rule, the Association reserves the right to petition the Federal Communications Commission for a waiver allowing the adoption of restrictions on antennas, which would otherwise be preempted. In the event that such a waiver is granted, antenna installations, which are not in compliance with such restrictions, may be required to be brought into compliance within a reasonable time as determined by the Association acting through the Design Committee.

Property Developed under the Condominium Property Regime (Multi-Family Homes): Owners who are members of condominium associations shall confer with the condominium association board of directors separately for other approvals, which may be required. Condominium associations may have additional and/or more stringent requirements related to installation of antennas and masts.

20. House Decorations

In general, tacked-on house decorations shall not be approved. Decorations for holidays or special occasions are exempt and need no approval, provided they are not constructed or applied sooner than fifteen (15) days before the event and are removed within fifteen (15) days after the event, visible from the street and/or neighboring properties.

21. House and Window Trimmings

House and window trimmings, such as scallops, ornate shutters, and/or wrought iron and other "gingerbread" effects shall not be approved by the Design Committee when they do not blend with the architecture of the existing dwelling, result in a "tacked on" appearance, or do not blend with the surrounding aesthetic quality of the community.

22. Window Related Improvements and Outdoor Furniture Accessories

All window shutters, window guards, benches, outdoor furniture, decorative trim work and other such accessories must be submitted to the Design Committee for approval, and will be reviewed

on a case-by-case basis. Accessories that are overly ornate and not in keeping with the general architectural theme of the community will not be approved under any circumstances.

Approval is required for any improvement related to the exterior windows, such as drop/retractable blinds, awnings, rolling shutters, window replacements, etc.

Reflective Finishes: Reflective finishes may not be used on exterior surfaces (other than the surfaces of hardware fixtures) where such exterior surface is visible from neighboring property.

Good and Clean Condition: All improvements shall be maintained in a good and clean condition and repair, and in such manner as to not create a fire, safety, or health hazard to Ewa by Gentry or any part thereof, all at such at Owner's sole cost and expense.

Types of Improvements:

Drop/Retractable Blinds and Stationary or Retractable Awnings:

A. Location: Blinds and awnings shall be mounted under the roof eaves or attached to the exterior of the main dwelling.

B. Colors: Garish, busy patterns, and bright colored blinds or awnings are not approvable. Colors shall match the existing color scheme of dwelling(s).

C. High Winds: Blinds and awnings shall be rolled and/or adequately tied down during periods of high winds to avoid slapping and banging, causing annoyance to adjacent residents.

D. Blinds shall be maintained neat, clean, and in good repair at all times.

E. Multi-Family Developments: Blinds and awnings for multi-family developments shall be of a single standard design, and approved by the development's Board of Directors prior to obtaining an EbGCA design permit. All Multi-Family requests must come from the Board and not individual owners.

Rolling Shutters over Windows:

Rolling shutters shall be used only for weather related disasters, such as hurricanes, and are not intended for 'daily use', such as for security, privacy, or shading purposes. Alternatives for such daily use needs are available, such as, burglar alarms, dogs, window tinting, drop blinds, curtains, etc.

A. Location: Rolling shutters shall be mounted over windows on the exterior of the dwelling. The dimensions of the shutters shall cover the exterior window area.

B. Color: Owners must submit samples of colors that will blend with the existing color scheme of the dwelling.

23. Window Treatments

Article IV, Section 4.02, Item d, line 16 of the DCC&R's states that "the back side of any drapes, blinds or other window shading devices which is visible from neighboring property through the window shall not be of bright or conspicuous color but rather white, off white, beige or other inconspicuous shade."

All window treatments such as draperies, blinds, curtains and other shading devices used on the interior and exterior of the windows and doors are subject to an ongoing evaluation by the Ewa by Gentry Community Association. Printed or patterned curtains are not allowed. All treatments or coverings must be acceptable materials intended for that specific use. Examples of materials not acceptable are all reflective materials (foil), newspapers, cardboard, posters, stickers, pictures, bed sheets, tarps, plastic films and paint.

It is each homeowner's responsibility to maintain any acceptable window/door treatment in good condition. Any treatments that exhibit tears, rips, heavy discoloration or otherwise deemed unkempt in appearance is subject to an EbGCA request for removal and/or replacement.

Windows may not be removed and left "glassless" in any house or garage door for any reason. All missing window material must be replaced immediately.

24. Window Tinting

Article IV, Section 4.02, Item d, line 1 of the DCC&R's states that "no reflective finishes shall be used upon exterior surfaces (other than glass and the surfaces of hardware fixtures) if such exterior surfaces are visible from neighboring property."

All window tinting or overlay, unless specifically listed as "Pre-approved" must be approved by the Design Committee before installation. Tinting overlay will be reviewed on a case-by-case basis.

A sample, design of overlay and information brochure on the specific tint must accompany the signed application. Only gray and non-reflective tints will be approved. High reflective, mirror, color (such as red, purple, etc) or black tinting will not be approved under any conditions.

Pre-approved Tints

If you choose to use any of the tints listed below you must complete a **pre-approved tinting form** and submit a copy of a receipt or proof of service showing the type of pre-approved tint used. The form must be completed and filed at the association's office prior to installation. *See form page 60.*

The following tints are approved from TNT Tinting

A. Vista 28 (V-28)
B. Vista 38 (V-38)

The following tints are approved from Bekaert Specialty Films

A. Solar Gard, Stainless Steel 20 & 35
B. Panorama, Slate 20, 30 & 40

25. Security Window Grilles (Bars in Windows)

This will be reviewed on a case-by-case basis. If approval is granted, the following stipulations will apply:

A. Bars shall match the trim of the house. Owners must submit samples of colors that will blend with the existing color palette of the property.
B. Bars may not clash with the window treatments.
C. Bars must meet all safety/fire codes.
D. Bars must be maintained in a neat and attractive manner in perpetuity.
E. Security window grilles may be placed over existing windows. The dimensions would follow the manufacturer's recommendations.
F. Security window grilles shall have emergency/safety release mechanisms per manufacturer's recommendations.
G. Reflective finishes may not be used on exterior surfaces (other than the surfaces of hardware fixtures) where such exterior surface is visible from neighboring property.
H. Security window grilles shall be maintained in a good and clean condition and repair, and in such manner as to not create a fire, safety, or health hazard to EbGCA or any part thereof, all at such at Owner's sole cost and expense.

26. Security Screen Door

Wrought Iron Security Doors with Screens are typically installed in place of standard front screen doors and sliding screen doors. Simple designs (vertical pickets) may be installed without Design Committee approval. Any designs that are NOT simple, which incorporate excessive scroll work, spires, sunburst, filigree or overly decorative elements require Design Committee approval.

A. Location and Dimensions: A security screen door shall be located on a door leading to the exterior of the dwelling. The dimensions of the security screen door shall cover the threshold of the door frame.

B. Colors: Owners must submit samples of colors that will blend with the existing, approved color of the trim. The colors of exterior surfaces visible from neighboring property shall be a color that blends with the existing, approved trim color (security screen door only).

C. Reflective Finishes: Reflective finishes may not be used on exterior surfaces (other than the surfaces of hardware fixtures) where such exterior surface is visible from neighboring property.

D. Good and Clean Condition: Security screen doors shall be maintained in a good and clean condition and repair, and in such manner as to not create a fire, safety, or health hazard to Ewa by Gentry or any part thereof, all at such at Owner's sole cost and expense.

27. Screen Doors (for front and back doors)

Approval is generally required for the installation of screen doors. These types of improvements are reviewed for aesthetic purposes only. Screen Doors may be installed without Design Committee approval provided they are simple in design (vertical pickets) and of a color that blends with the existing, approved trim color. Any designs that are NOT simple, which incorporate excessive scroll work, spires, sunburst, filigree or overly decorative elements require Design Committee approval. Homeowners must provide the committee a photo of your current door and a brochure of the proposed door.

28. Security Devices (such as cameras) and Accessories

A. Mounting of Security Devices: Exterior security devices shall be mounted under the roof eaves unless otherwise approved by the Design Committee. In the event the device cannot be installed under roof eaves, the Owner shall be required to conceal the fixture. If the device is mounted on the gable end of the house (for gable roofs), it shall be mounted within twelve (12) inches parallel to the roof slope.

B. Illumination of Security Devices: Refer to Design Committee Rule #37 for guidance on light illuminating on or near the security device. In all cases, any exterior device and its accessories shall have its light source diffused or shielded from view of the street or adjacent properties.

C. Visibility from Neighboring Properties and Street: At all times, the security device shall not be directed into neighboring properties. Any fixture that generates a complaint from neighboring property (and verified by the Association) shall be redirected, relocated, removed or concealed upon demand by EbGCA.

D. Limitations: The Association reserves the right to limit the areas that fixtures shall be installed should such installation not meet Design Committee aesthetic criteria or where a more unobtrusive location can be utilized. Fixtures proposed to be mounted between the first and second floors of a residence that do not have an eave or "eyebrow" may install a fixture at or within twelve (12) inches of the fascia line.

29. Tents and Temporary Structures

Tents and temporary structures such as lean-tos, luau enclosures, etc., may be erected without Design Committee approval, provided the Owner does not continue to use the tent or temporary structure beyond the special event for which it has been erected and expeditiously removes the tent or temporary structure immediately after its use. Maximum four (4) consecutive days to include set-up and removal.

30. Canopies, Canvas Coverings, Tarps, Mobile Homes and Permanent Tents

The Design Committee does not allow material canopies, canvas gazebos, or tarps and the associated framing materials as a permanent shade structure. No Owner shall keep, place or

maintain any trailer, mobile home, permanent tent or similar facility or structure upon any lot at any time.

All tarps, including white, blue, silver, gray, green and/or any other color are strictly prohibited within the community. The ONLY exception is a temporary party tent or structure, which may be erected for a maximum of four consecutive days (to include set up and removal). Otherwise, tarps are prohibited, including those used for vehicle covers, hot tub, spa or pool covers, bike or motorcycle covers, boat covers and covering for storage of any kind at any time for any purpose in any community.

31. Air Conditioning Units

Installations of all air conditioning units require Design Committee approval and must adhere to the following guidelines:

A. All visible air conditioner units must be or appear to be new. If a unit appears used or is rusty, damaged, bent, etc., it must be screened from view by applying an approved screen to conceal the unit from view of the street or adjacent property. Any discoloring or evidence of dripping from any air conditioner unit must be repaired immediately.

B. All window unit air conditioners must be adequately framed and secured to prevent dislodging during high winds. All framing must be painted to match the color of the window frame to minimize the visibility of the framing. No bare metal or conspicuous filter elements or framing elements may be exposed. **No raw wood may be visible around any air conditioner**.

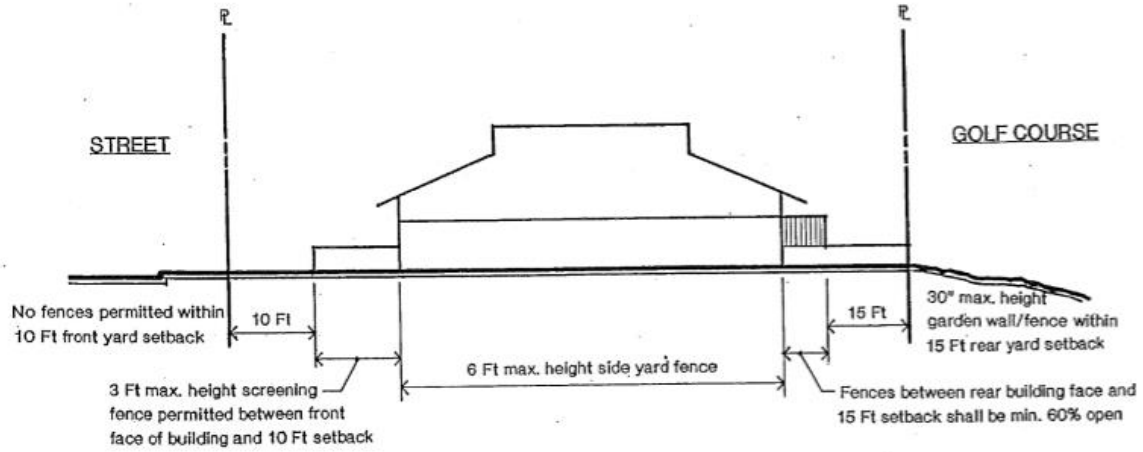
C. All air conditioning electrical conduit, wiring, mechanical piping and condensate drain lines must be grouped together and concealed from view. Concealment may be accomplished within existing wall or siding panels, or encased with molding and painted to match the surface to which it is attached.

D. All visible air conditioners must be maintained over time including painting, attractive framing, rust control, concealment of wires, tubes, etc.

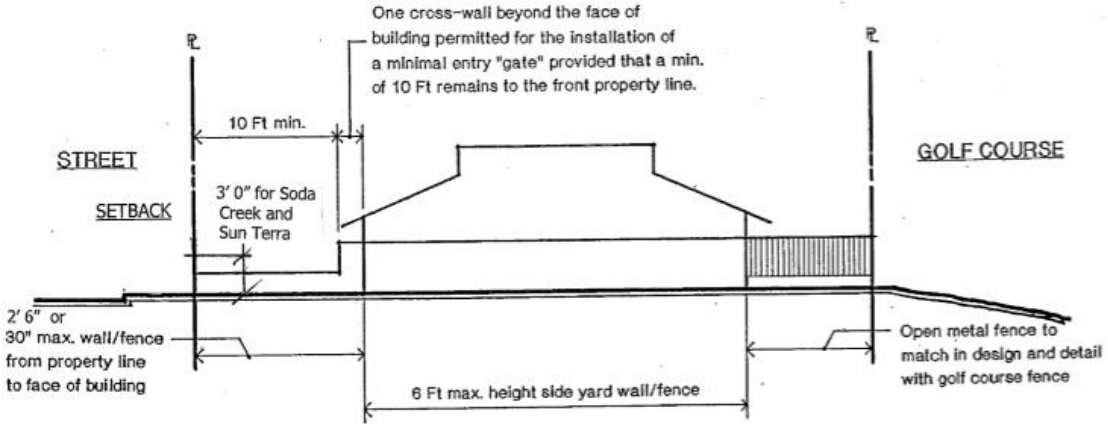
E. The Owner is responsible for insuring quiet operation of all installed air conditioning units. If the Covenants Department determine that an air conditioning unit is being operated at an excessive noise level that may be a disturbance to adjacent neighbors, the Owner may be required to remove or modify the unit to reduce the noise level.

F. Split system compressor must not be visible from the street or neighboring properties. If concrete is needed for an A/C pad, the concrete must be applied for separately.

G. Air conditioner units installed by the developer must adhere to these rules.



EXISTING MODIFICATION GUIDELINES



ACCEPTABLE MODIFICATION VARIANCES

ILLUSTRATION 1

Where fences are used in combination with walls, the six foot maximum shall apply to the wall and fence combination.

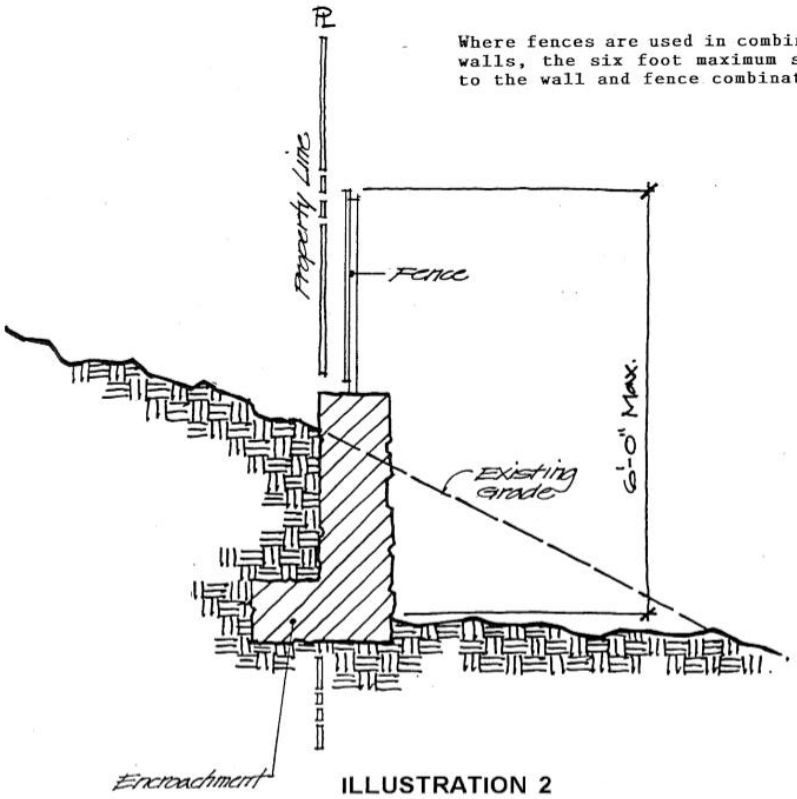


ILLUSTRATION 2

RETAINING WALL/FENCE

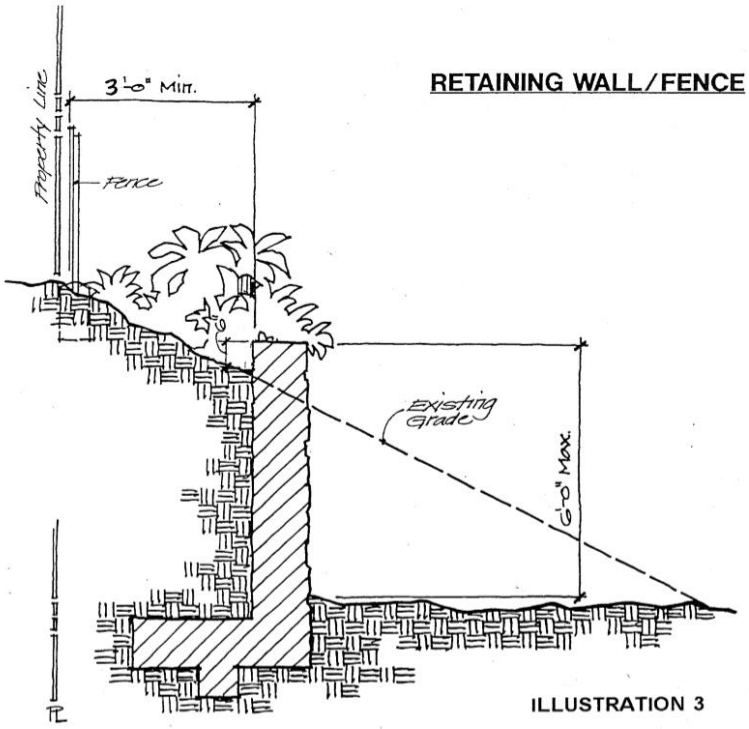


ILLUSTRATION 3

CORNER LOTS

At corner lots where side yard walls/fences extend into front yards (yards fronting streets) the top of the side yard wall shall be transitioned to a maximum height of thirty inches, any point above the sidewalk, at the property line. The envelope governing the construction height within this area shall be a line measured from the existing building line six feet in height to a point thirty inches high at the property line. Note that the envelope is a maximum and not necessarily indicative of the wall/fence design.

This variance condition is not acceptable at front yards with driveways, and mainly serves to address difficult slope conditions at corner lots.

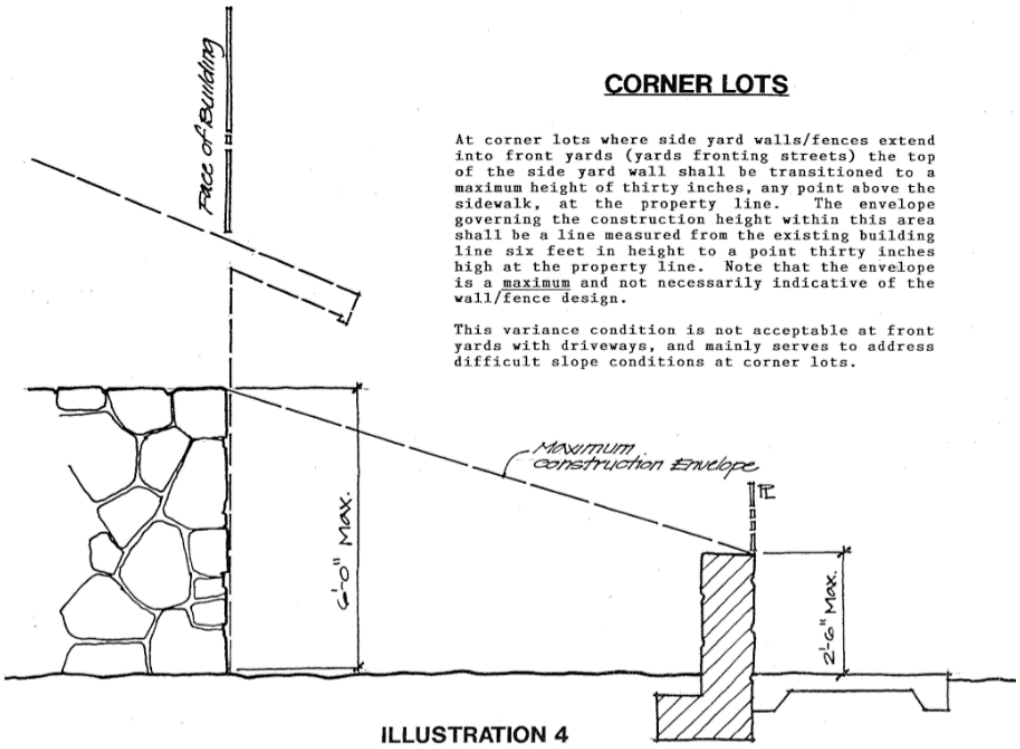


ILLUSTRATION 4

JOINTLY DEVELOPED WALLS & FENCES

Jointly developed walls and fences are allowed on common property lines (side and rear yards). The maximum height of the fence portion shall be six feet as measured from the original grade at the common property line.

Where retaining walls are used in conjunction with fences the maximum exposed wall face shall be limited to six feet as measured from the existing or finish grade whichever is lower.

Where retaining walls are used in conjunction with fences the maximum exposed wall face shall be limited to six feet as measured from the existing or finish grade whichever is lower.

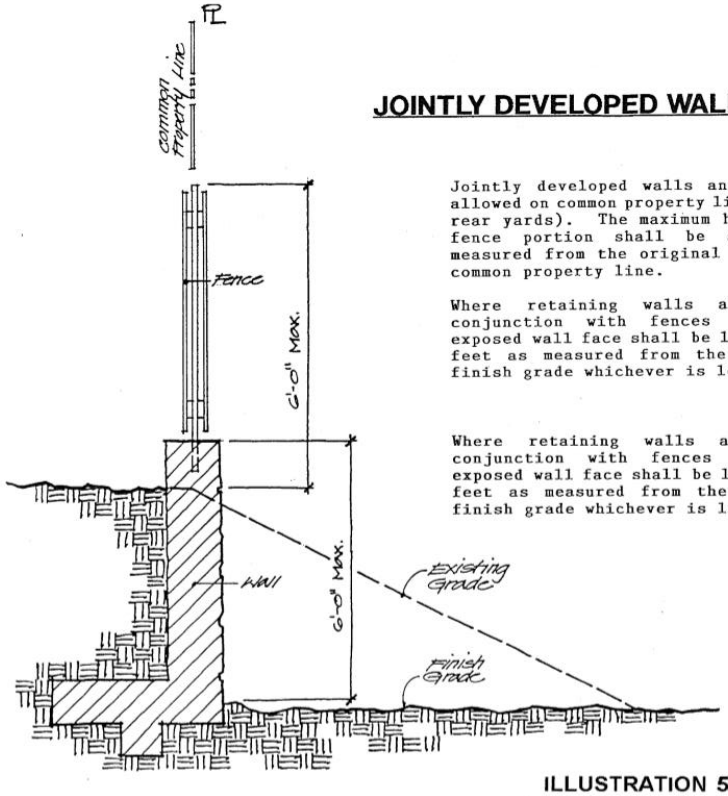
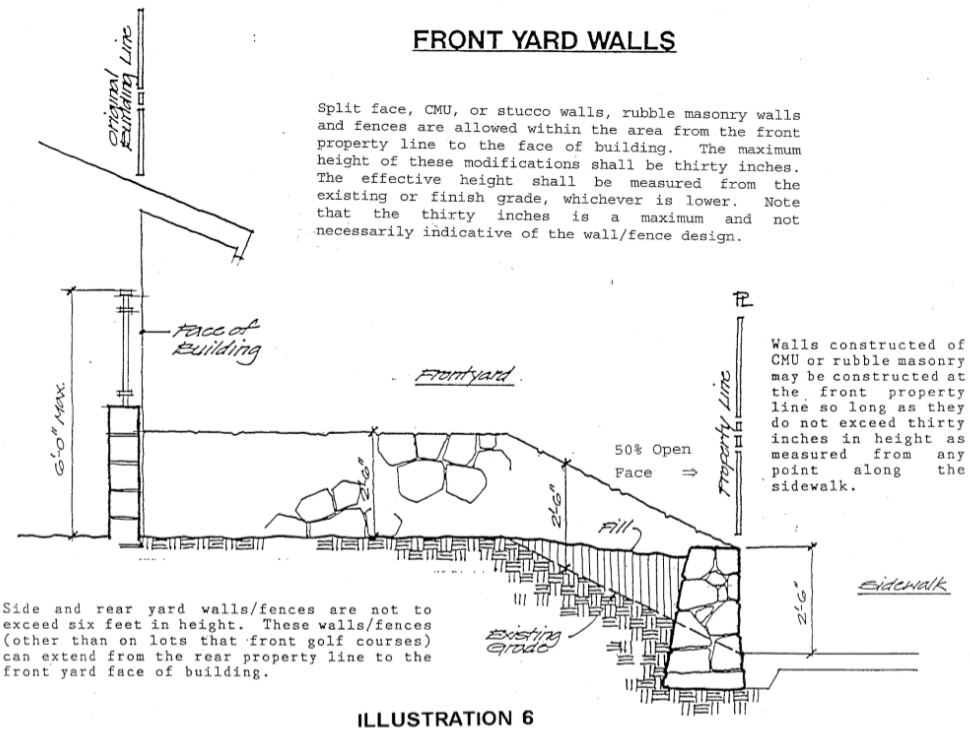


ILLUSTRATION 5

FRONT YARD WALLS

Split face, CMU, or stucco walls, rubble masonry walls and fences are allowed within the area from the front property line to the face of building. The maximum height of these modifications shall be thirty inches. The effective height shall be measured from the existing or finish grade, whichever is lower. Note that the thirty inches is a maximum and not necessarily indicative of the wall/fence design.



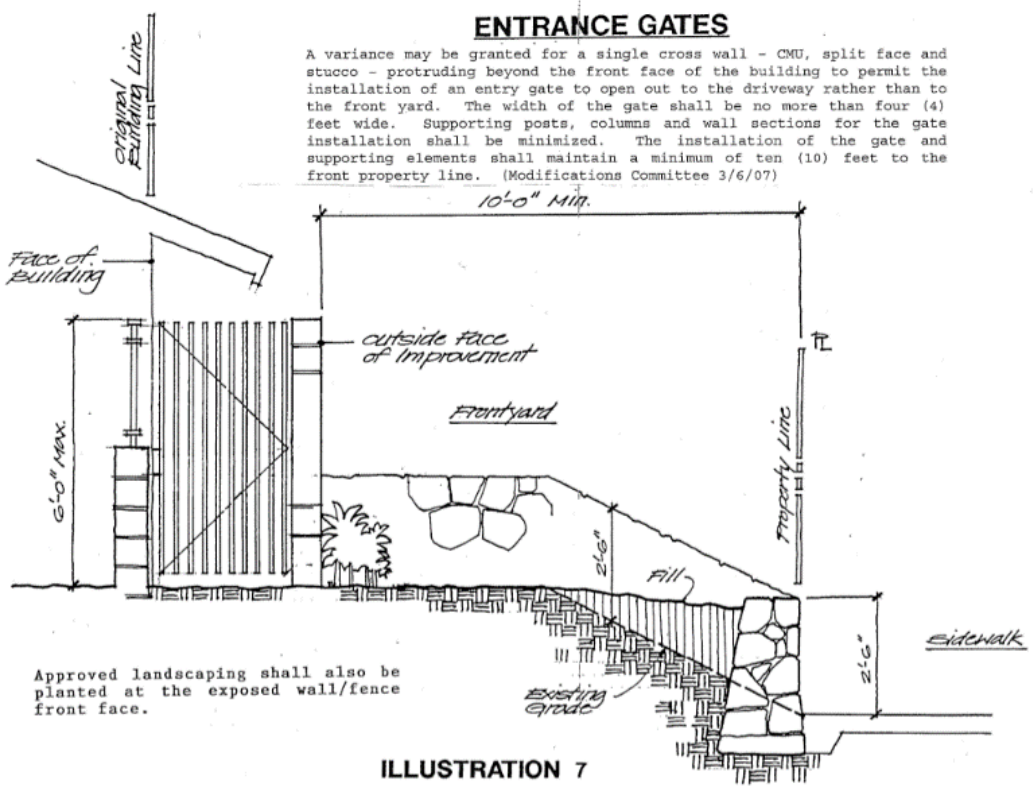
Walls constructed of CMU or rubble masonry may be constructed at the front property line so long as they do not exceed thirty inches in height as measured from any point along the sidewalk.

Side and rear yard walls/fences are not to exceed six feet in height. These walls/fences (other than on lots that front golf courses) can extend from the rear property line to the front yard face of building.

ILLUSTRATION 6

ENTRANCE GATES

A variance may be granted for a single cross wall - CMU, split face and stucco - protruding beyond the front face of the building to permit the installation of an entry gate to open out to the driveway rather than to the front yard. The width of the gate shall be no more than four (4) feet wide. Supporting posts, columns and wall sections for the gate installation shall be minimized. The installation of the gate and supporting elements shall maintain a minimum of ten (10) feet to the front property line. (Modifications Committee 3/6/07)



Approved landscaping shall also be planted at the exposed wall/fence front face.

ILLUSTRATION 7

CORNER LOTS

Variances for stand alone metal fences at the long side of front yards at corner lots will be considered.

Stand alone open metal fences can be placed anywhere within the longer front yard, limited in height to six feet as measured from the existing grade.

The extent of the fence shall be limited by the Department of Transportation Services line-of-sight restriction and/or the front plane of the house or garage.

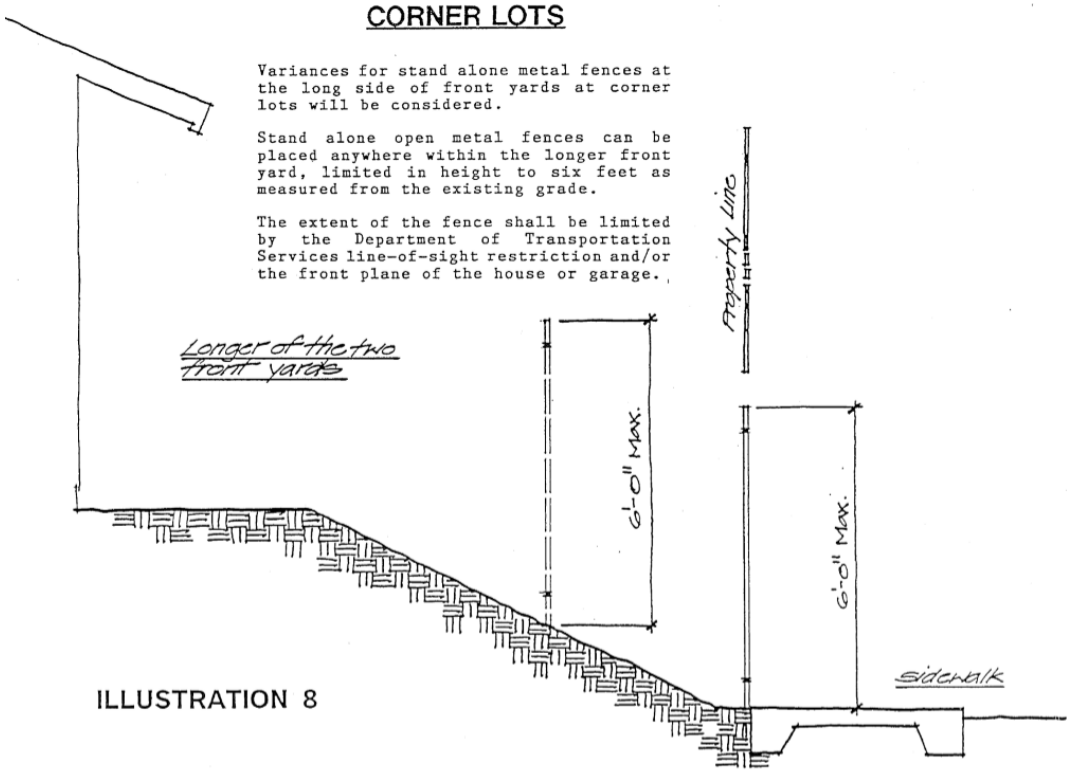


ILLUSTRATION 8

CORNER LOTS

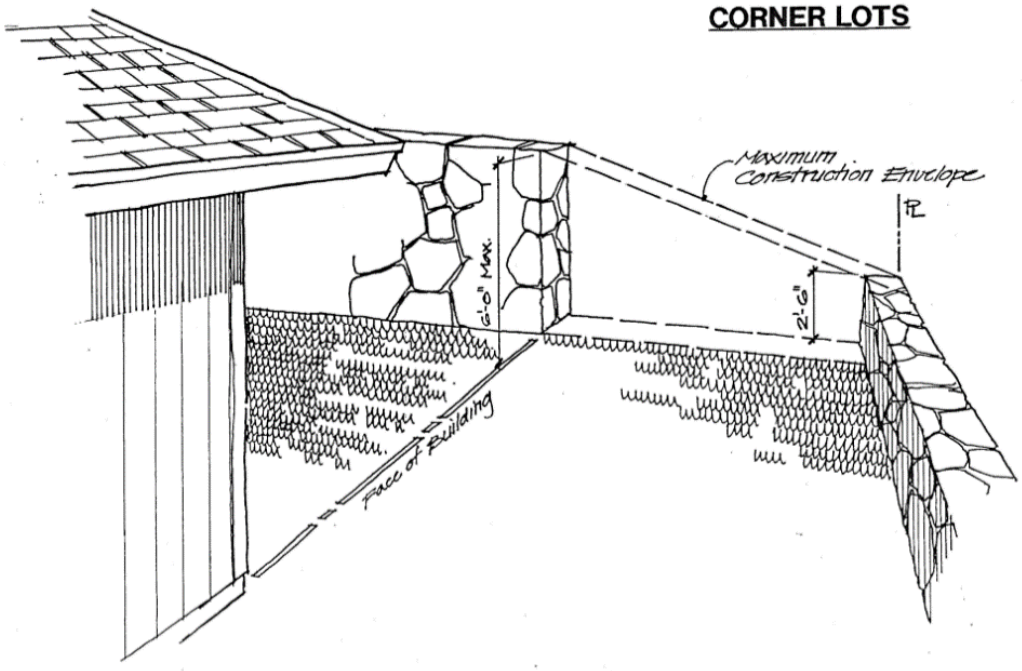
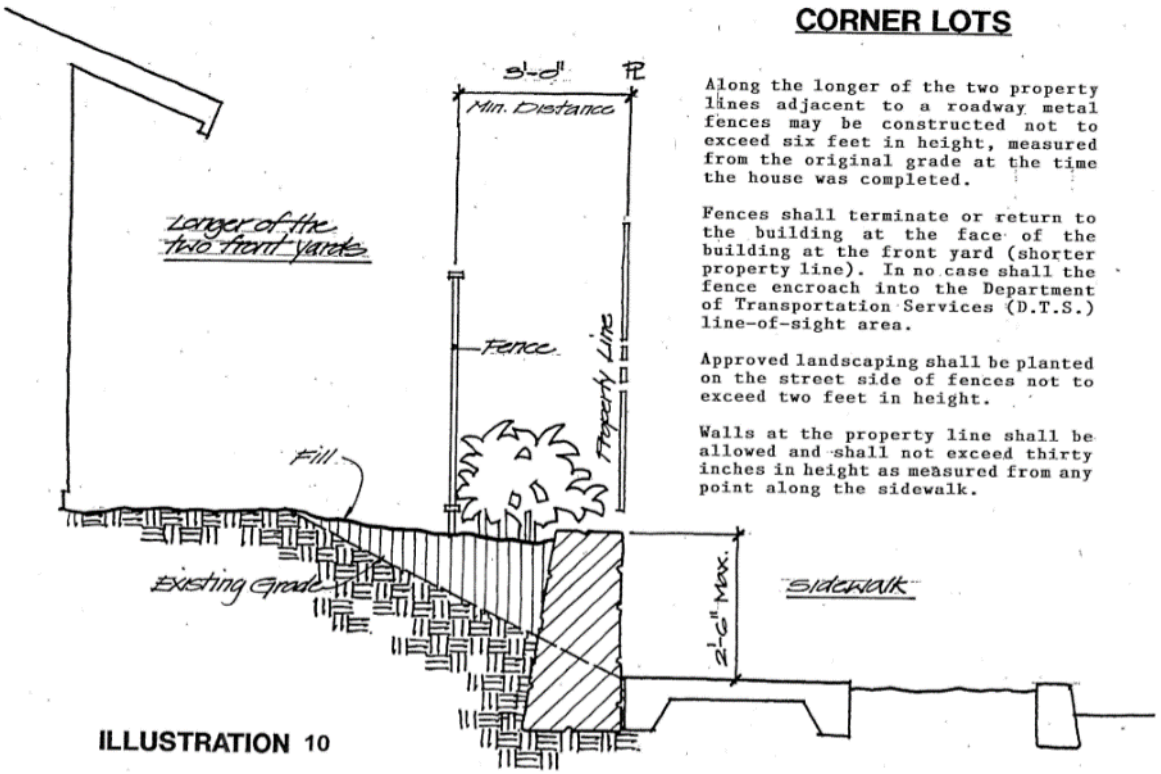


ILLUSTRATION 9

CORNER LOTS



Along the longer of the two property lines adjacent to a roadway metal fences may be constructed not to exceed six feet in height, measured from the original grade at the time the house was completed.

Fences shall terminate or return to the building at the face of the building at the front yard (shorter property line). In no case shall the fence encroach into the Department of Transportation Services (D.T.S.) line-of-sight area.

Approved landscaping shall be planted on the street side of fences not to exceed two feet in height.

Walls at the property line shall be allowed and shall not exceed thirty inches in height as measured from any point along the sidewalk.

ILLUSTRATION 10

METAL FENCES

Where allowable, metal fences can be constructed within front yards. The fence shall be no higher than six feet as measured from the existing or finish grade, whichever is lower.

Pickets shall be a maximum of 3/4 inch in dimension, spaced a minimum of five inches on center.

Support posts shall be spaced a recommended six to eight feet apart and shall be a maximum of two inches in any dimension.

Top and bottom rails shall be a maximum of one and one-half inches in any dimension.

Fence colors, decorative caps and designs are subject to Modifications Committee review.

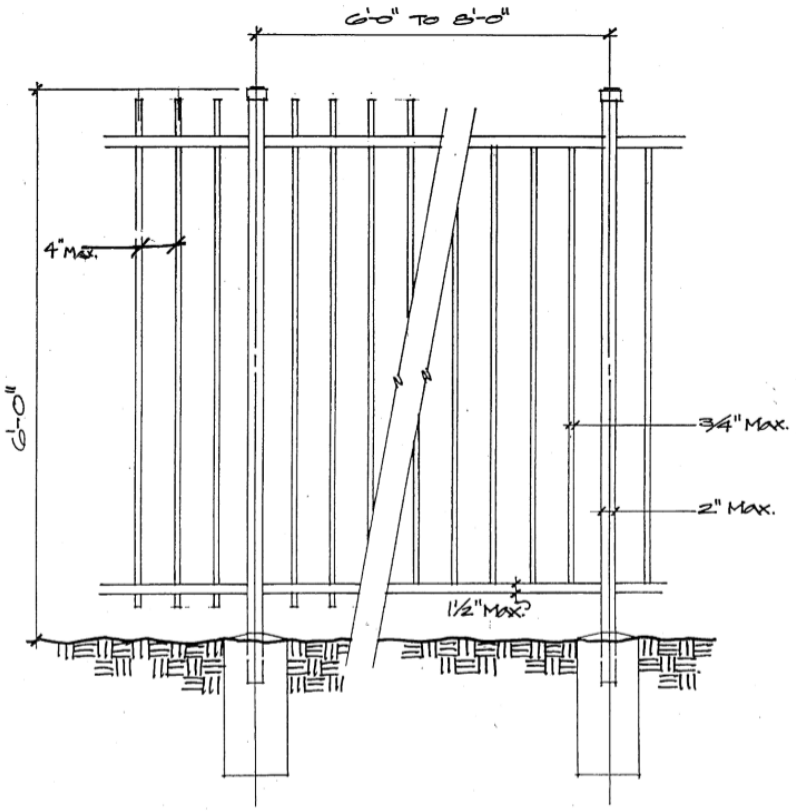
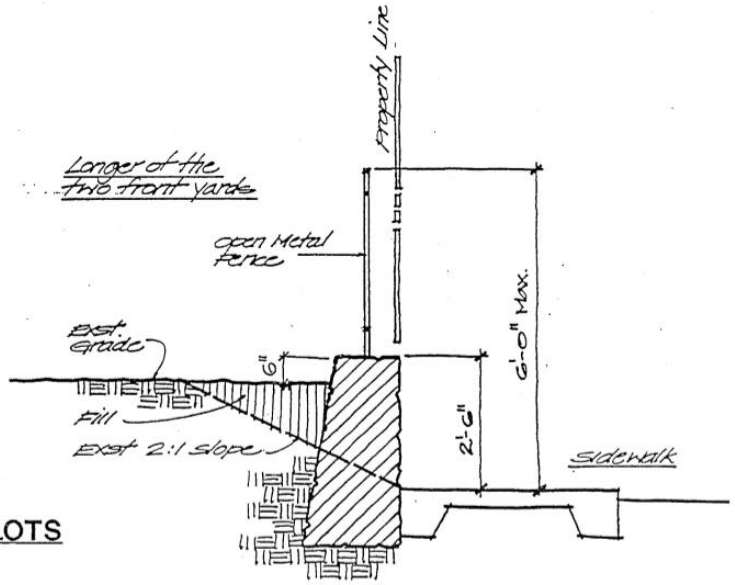


ILLUSTRATION 11

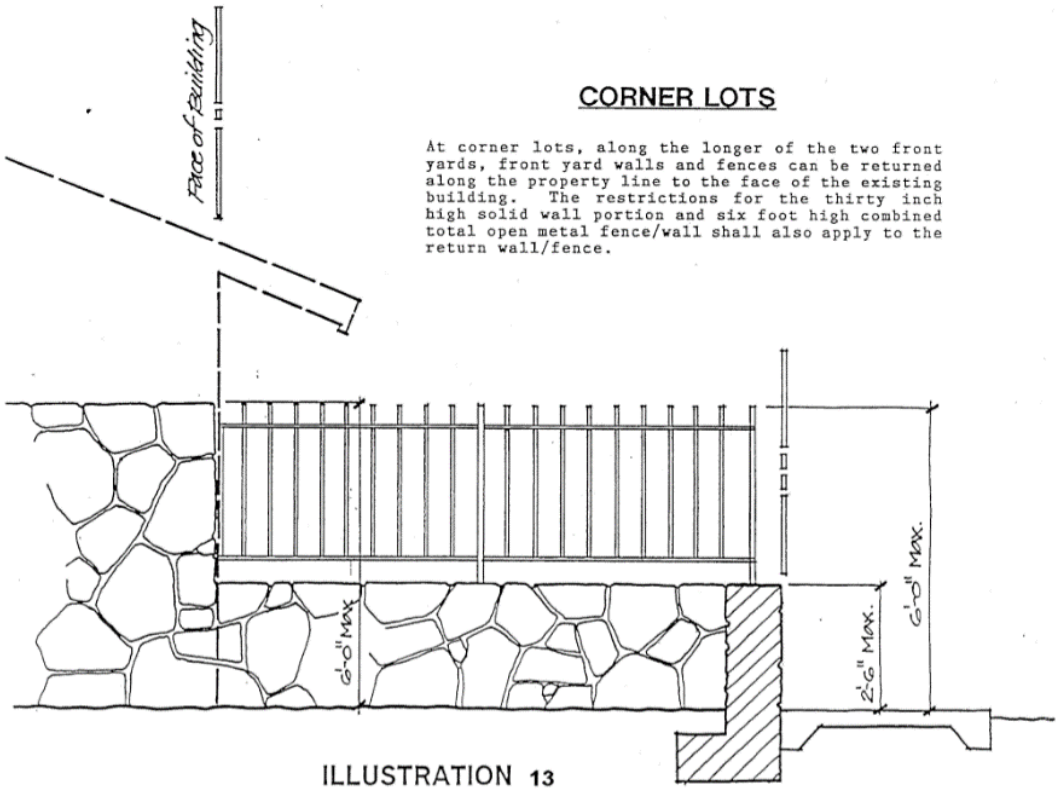


CORNER LOTS

Variances for wall/open metal fence combinations at the long side of front yards at corner lots will be considered. The solid wall portion will be limited to thirty inches, as measured from the sidewalk, with the open metal portion limited to the total wall/fence height of six feet.

The extent of the wall/fence shall also be limited by the Department of Transportation Services line-of-sight restriction and/or the front plane of the house or garage.

ILLUSTRATION 12



CORNER LOTS

At corner lots, along the longer of the two front yards, front yard walls and fences can be returned along the property line to the face of the existing building. The restrictions for the thirty inch high solid wall portion and six foot high combined total open metal fence/wall shall also apply to the return wall/fence.

ILLUSTRATION 13

CORNER LOTS

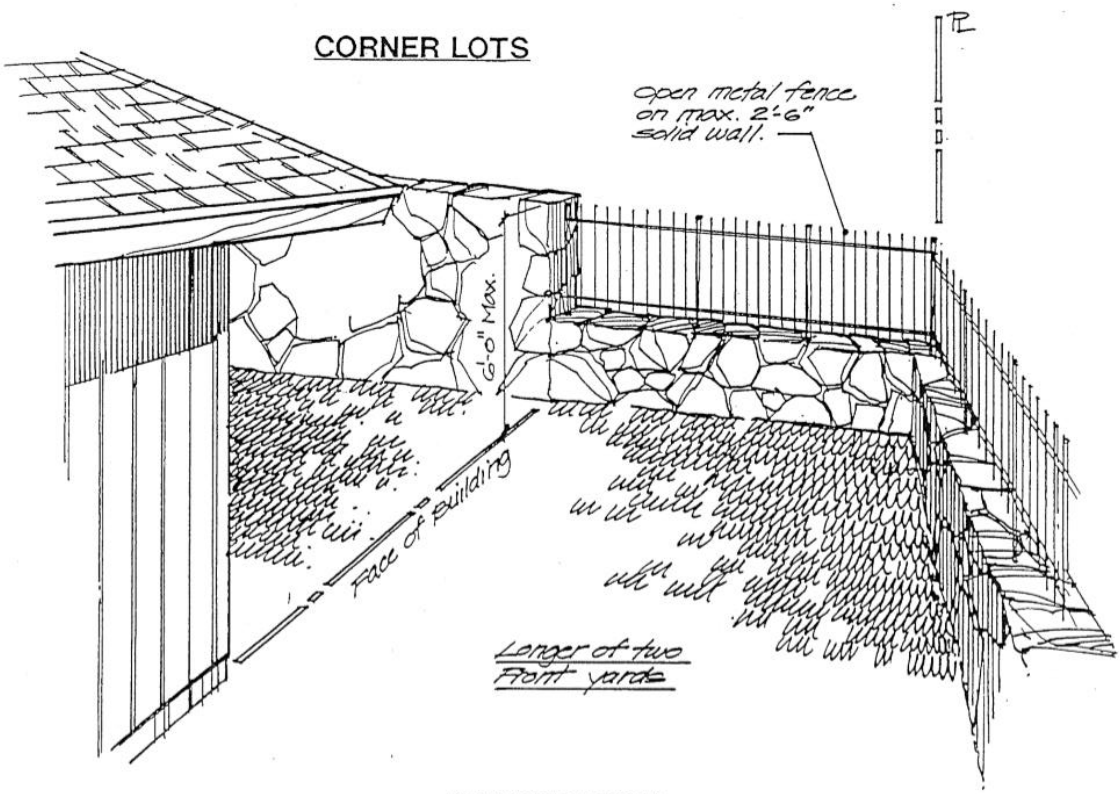


ILLUSTRATION 14

CORNER LOTS

Along the longer of the two front yards solid walls (rubble, CMU) at the property line will be allowed not to exceed thirty inches in height, as measured from the sidewalk elevation. Additionally, open metal fences on these walls will be allowed to a total maximum wall/fence height of six feet.

At the rear of the property, this same front yard wall/fence can be returned at the property line. The requirement for openness shall be maintained until the face of the building is reached.

Where house entries are located along the longer front yard the front yard wall/fence can be returned to the face of the house (not garage).

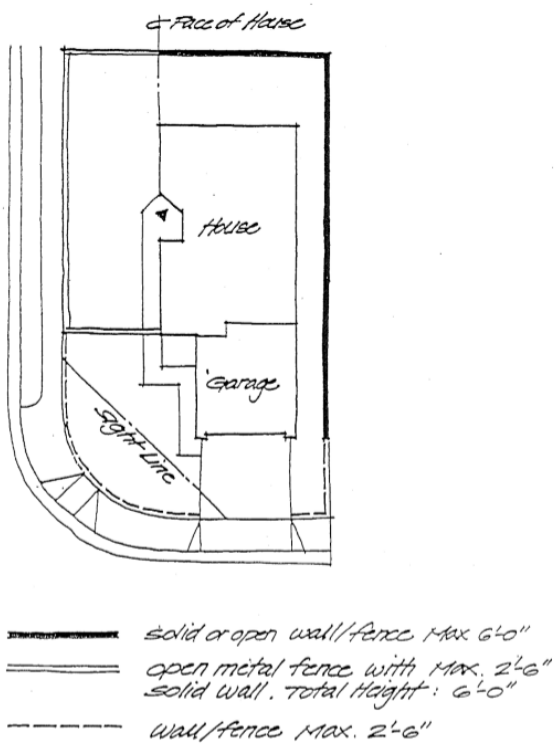


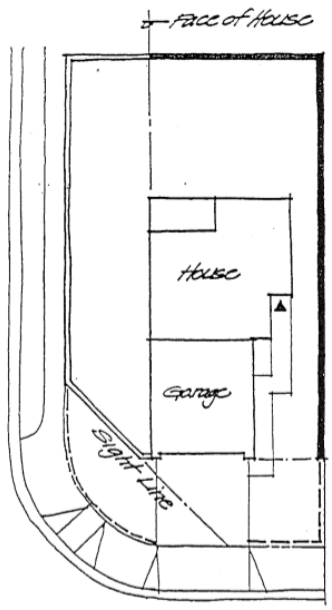
ILLUSTRATION 15

CORNER LOTS

Along the longer of the two front yards solid walls (rubble, CMU) at the property line will be allowed not to exceed thirty inches in height, as measured from the sidewalk elevation. Additionally, open metal fences on these walls will be allowed to a total maximum wall/fence height of six feet.

At the rear of the property, this same front yard wall/fence can be returned at the property line. The requirement for openness shall be maintained until the face of the building is reached.

Where house entries are located at the interior of the property and not along the longer front yard, the front yard wall/fence can be returned to the face of the garage (not house).

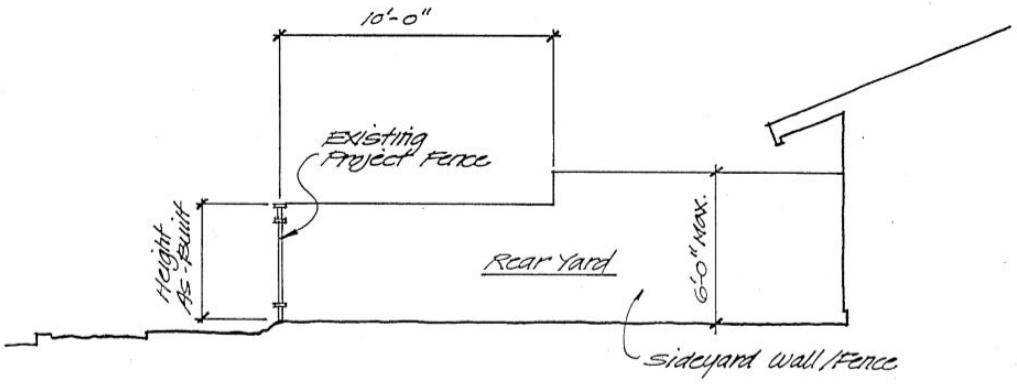


solid or open wall/fence Max. 6'-0"

open metal fence with Max. 2'-6" Solid wall. Total Height: 6'-0"

wall/fence Max. 2'-6"

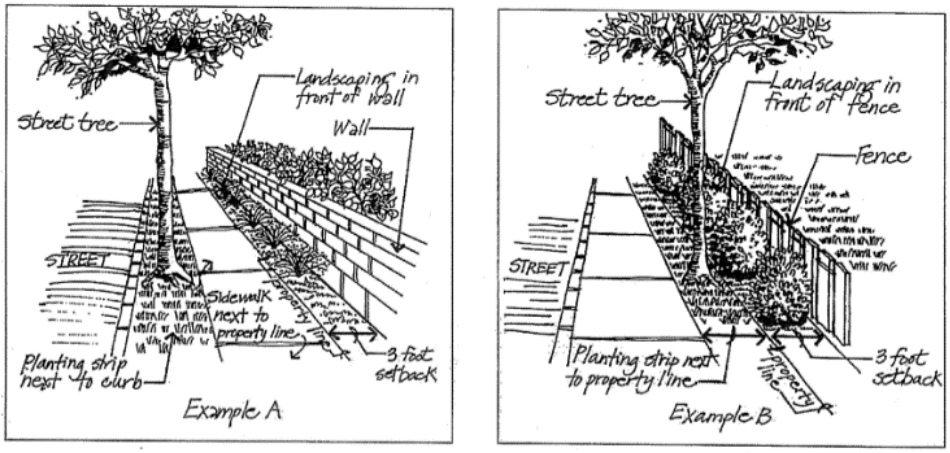
ILLUSTRATION 16



FENCES ABUTTING EXISTING PROJECT FENCES

Where sideyard fences abut existing subdivision fences at the rear of the property (with the exception of golf course frontages and other restricted design areas), the sideyard fence(s) shall be transitioned to no more than the existing project fence height for a distance of ten feet from the rear property line.

ILLUSTRATION 17



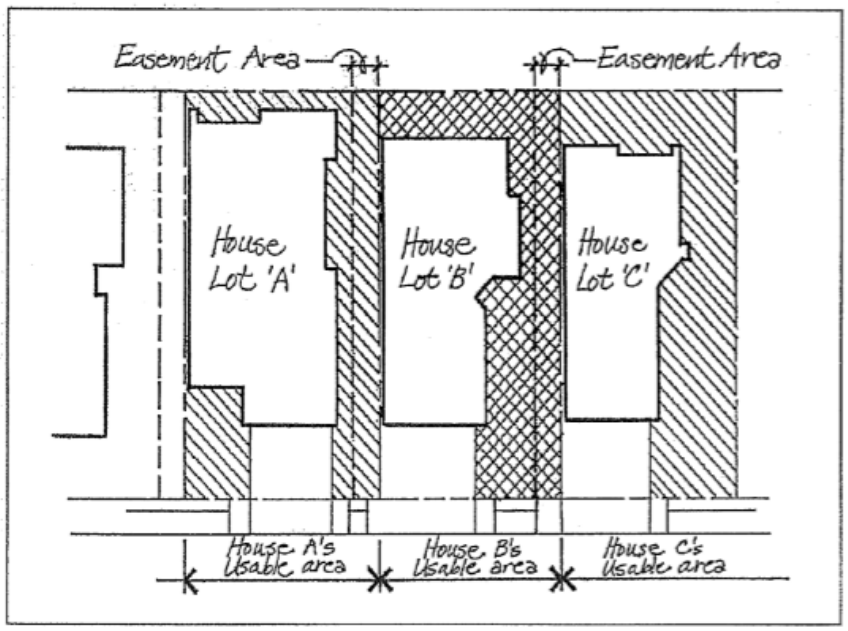
This is a sample diagram for landscaping in front of a fence.

There are special design controls for certain neighborhood. In some neighborhoods, the front property line is located along the edge of the sidewalk (example A). In others, the sidewalk is located next to the street curb and is separated from the property line by a three foot wide planting area (example B). In all instances, the planting area in front of the wall or fence must be landscaped. You must also maintain this area and any planting that occurs between your property line and the street.

ILLUSTRATION 18

Maintenance Easements and Sideyard Easements

Many of the single-family lots in Ewa by Gentry have either maintenance or sideyard easements granted to the adjacent neighbor. These easements allow homeowners approximately ten feet of land to one side of their homes for light, air, and landscaping.

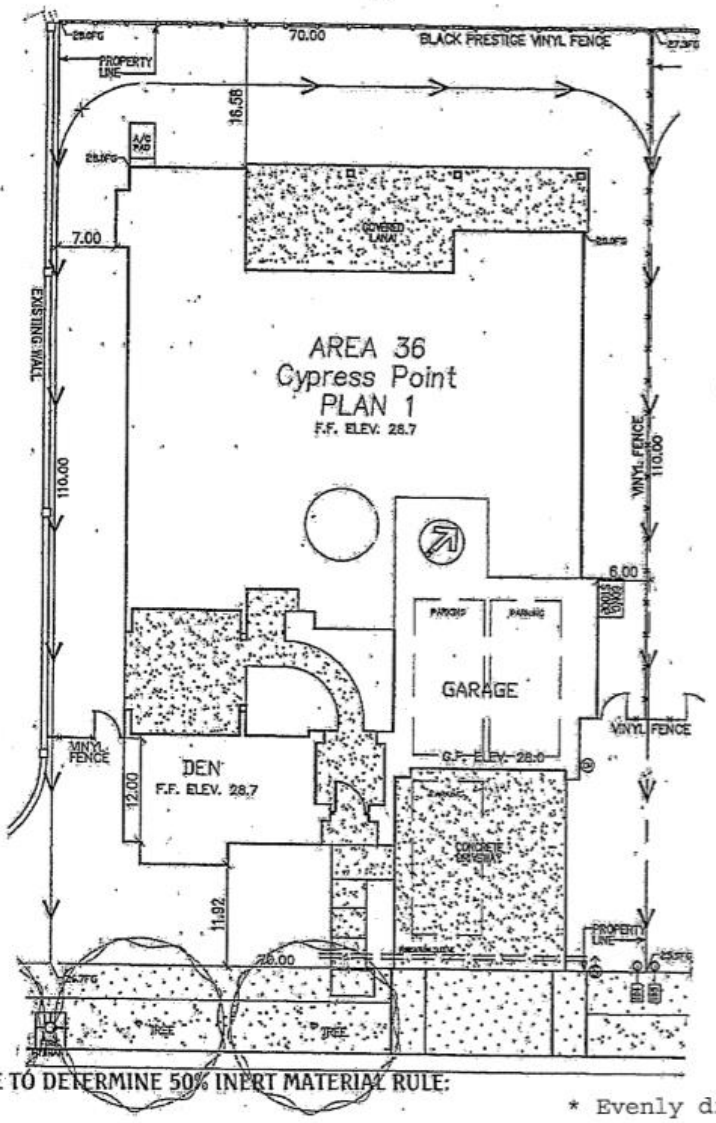


When you landscape the side of your house where the easement is located, you must comply with the City's Zoning Code (known as the Land Use Ordinance or L.U.O.), the Ewa by Gentry Covenants, and the Declaration of Restrictive Covenants for zero lot line development (if applicable to your lot). Other restrictions may be contained in your property deed. Please review all of these documents before landscaping.

You must also ensure that your landscape plan does not interfere with your neighbor's ability to maintain the side of his house and fence. If you intend to build any structure, you must obtain the approval of the Ewa by Gentry Community Association Design Committee and possibly a building permit. You may also be directed to obtain your neighbor's approval. You should check with the Covenants Manager before you improve the area to see if Design Committee approval is required and, also, with the City Building Department to see if a building permit is required.

Maintenance and sideyard easements apply to zero lots only.

ILLUSTRATION 19



THIS IS A SAMPLE TO DETERMINE 50% INERT MATERIAL RULE:

* Evenly distributed

7700sf - 2513 sf (house), - 639sf (garage), - 606sf (lanai), - 136sf (covered entry) = 3806sf
3806sf multiply by 50% = 1903sf (minimum amount required for landscaping with living ground covering). Additonal concrete sidewalk will be taken from 1903sf to determine the percentage of inert material used.

DATE: 07/27/06	SCALE: 1" = 16'
REVISIONS	
DATE	DESCRIPTION

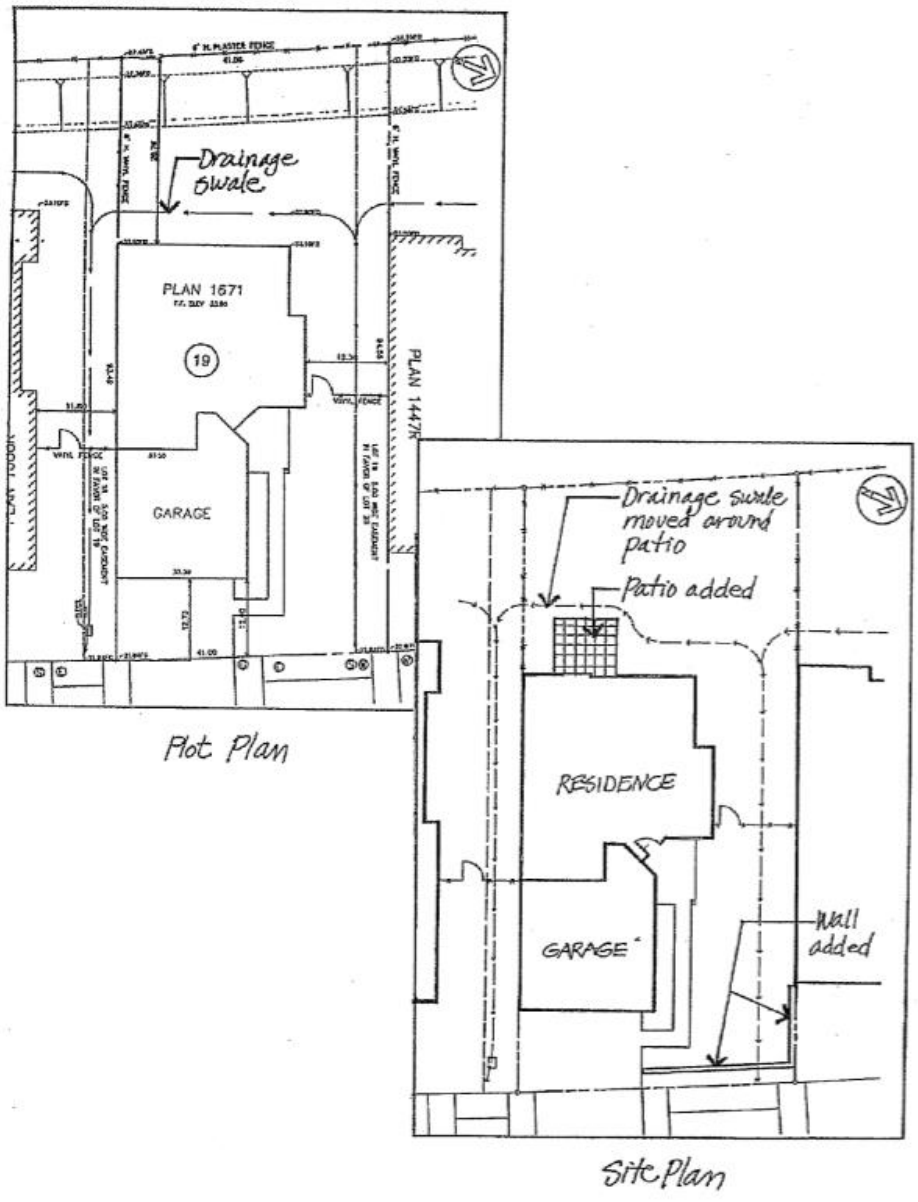
CYPRESS POINT
BY GENTRY
AREA 36 – PHASE 3
ADDRESS:
LAND COURT NO.:
LOT AREA: 7700 SF

CARMEL - Plan 1
3 Bedroom, 3 Bath
with Den

Total Living Area	2,513 SF
Covered Entry Gate	121 SF
Covered Entry	15 SF
Lanai 1	206 SF
Lanai 2	400 SF
Garage	639 SF
Total Floor Area	3,894 SF

LTD.
96809

ILLUSTRATION 20

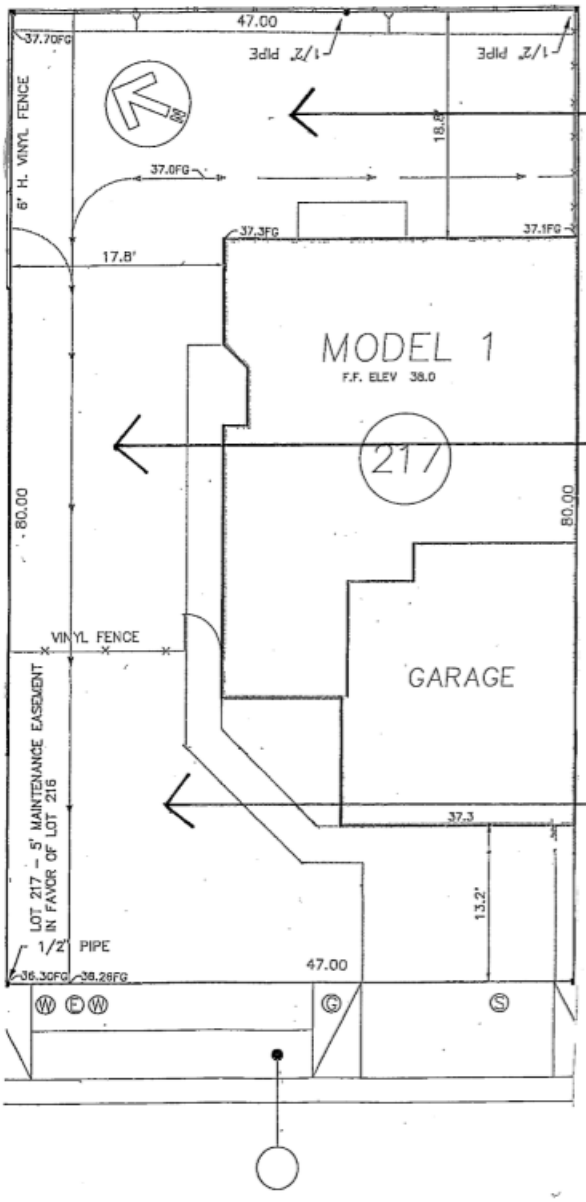


Plot Plan versus Site Plan

ILLUSTRATION 21

INERT MATERIAL RULE & EXAMPLE:

The Owner shall landscape the front, back yard and planting strip(s) between the sidewalk and the street or curb line within three (3) months after closing. The use of non-living or inert materials is acceptable if 50% of the yard is planted. Inert material may not exceed 50% of the entire plantable yard, including front, side, and rear yards and it may not be concentrated in one area; ***it must be evenly distributed throughout the entire lot***. If you plan to install any inert (non-living i.e. rock, gravel, concrete) material in your yard or planter strip at the front of your property, you must first consult either Ewa by Gentry office or the City & County of Honolulu for the planter strip.



50% of the Backyard

Backyard exceptions include an extension or the construction of a pool with deck and other features such as waterfalls, etc. Then the remaining open space MUST be planted with living material. No additional inert material will be allowed or approved.

50% of the Side Yards

For some conditions including the shady side of a walk-around lot, the DC will approve the shady side-yard to be solid inert material, while the other side-yard must be planted with living material.

50% of the Front Yard

The 50% inert material in the front yard must be evenly spaced to present a neat, clean and well-designed front yard landscape. To reiterate the above, "**it must be evenly distributed throughout the entire lot**". No exceptions will be considered.

NOTE: **All** inert material requires Design Committee approval FIRST! Don't build without getting approval!

ILLUSTRATION 22

Appendix B:

International Building Code 2012, Chapter 31 – Special Construction, Section 3109

SECTION 3109 SWIMMING POOL ENCLOSURES AND SAFETY DEVICES

3109.1 General.
Swimming pools shall comply with the requirements of Sections 3109.2 through 3109.5 and other applicable sections of this code.

3109.2 Definition.
The following term is defined in Chapter 2:

SWIMMING POOLS.

3109.3 Public swimming pools.
Public swimming pools shall be completely enclosed by a fence not less than 4 feet (1290 mm) in height or a screen enclosure. Openings in the fence shall not *permit* the passage of a 4-inch-diameter (102 mm) sphere. The fence or screen enclosure shall be equipped with self-closing and self-latching gates.

3109.4 Residential swimming pools.
Residential swimming pools shall comply with Sections 3109.4.1 through 3109.4.3.

Exception: A swimming pool with a power safety cover or a spa with a safety cover complying with ASTM F 1346 need not comply with Section 3109.4.

3109.4.1 Barrier height and clearances.
The top of the barrier shall be not less than 48 inches (1219 mm) above grade measured on the side of the barrier that faces away from the swimming pool. The vertical clearance between grade and the bottom of the barrier shall be not greater than 2 inches (51 mm) measured on the side of the barrier that faces away from the swimming pool. Where the top of the pool structure is above grade, the barrier is authorized to be at ground level or mounted on top of the pool structure, and the vertical clearance between the top of the pool structure and the bottom of the barrier shall be not greater than 4 inches (102 mm).

3109.4.1.1 Openings.
Openings in the barrier shall not allow passage of a 4-inch-diameter (102 mm) sphere.

3109.4.1.2 Solid barrier surfaces.
Solid barriers which do not have openings shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.

3109.4.1.3 Closely spaced horizontal members.
Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall be not greater than $1^3/_4$ inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall be not greater than $1^3/_4$ inches (44 mm) in width.

3109.4.1.4 Widely spaced horizontal members.
Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall be not greater than 4 inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall be not greater than $1^3/_4$ inches (44 mm) in width.

3109.4.1.5 Chain link dimensions.
Mesh size for chain link fences shall be not greater than a $2^1/_4$ inch square (57 mm square) unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than $1^3/_4$ inches (44 mm).

3109.4.1.6 Diagonal members.
Where the barrier is composed of diagonal members, the opening formed by the diagonal members shall be not greater than $1^3/_4$ inches (44 mm).

3109.4.1.7 Gates.
Access doors or gates shall comply with the requirements of Sections 3109.4.1.1 through 3109.4.1.6 and shall be equipped to accommodate a locking device. Pedestrian access doors or gates shall open outward away from the pool and shall be self-closing and have a self-latching device. Doors or gates other than pedestrian access doors or gates shall have a self-latching device. Release mechanisms shall be in

accordance with Sections 1008.1.9 and 1109.13. Where the release mechanism of the self-latching device is located less than 54 inches (1372 mm) from the bottom of the door or gate, the release mechanism shall be located on the pool side of the door or gate 3 inches (76 mm) or more, below the top of the door or gate, and the door or gate and barrier shall be without openings greater than $^1/_2$ inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.

3109.4.1.8 Dwelling wall as a barrier.
Where a wall of a *dwelling* serves as part of the barrier, one of the following shall apply:

1. Doors with direct access to the pool through that wall shall be equipped with an alarm that produces an audible warning when the door and/or its screen, if present, are opened. The alarm shall be *listed* and labeled in accordance with UL 2017. In dwellings not required to be *Accessible units*, *Type A units* or *Type B units*, the deactivation switch shall be located 54 inches (1372 mm) or more above the threshold of the door. In dwellings required to be *Accessible units*, *Type A units* or *Type B units*, the deactivation switch shall be located not higher than 54 inches (1372 mm) and not less than 48 inches (1219 mm) above the threshold of the door.

2. The pool shall be equipped with a power safety cover that complies with ASTM F 1346.

3. Other means of protection, such as self-closing doors with self-latching devices, which are *approved* , shall be accepted so long as the degree of protection afforded is not less than the protection afforded bySection 3109.4.1.8, Item 1 or 2.

3109.4.1.9 Pool structure as barrier.
Where an aboveground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then the ladder or steps either shall be capable of being secured, locked or removed to prevent access, or the ladder or steps shall be surrounded by a barrier which meets the requirements of Sections 3109.4.1.1 through 3109.4.1.8. Where the ladder or steps are secured, locked or removed, any opening created shall not allow the passage of a 4-inch-diameter (102 mm) sphere.

3109.4.2 Indoor swimming pools.
Walls surrounding indoor swimming pools shall not be required to comply with Section 3109.4.1.8.

3109.4.3 Prohibited locations.

Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

3109.5 Entrapment avoidance.

Suction outlets shall be designed and installed in accordance with ANSI/APSP-7.

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